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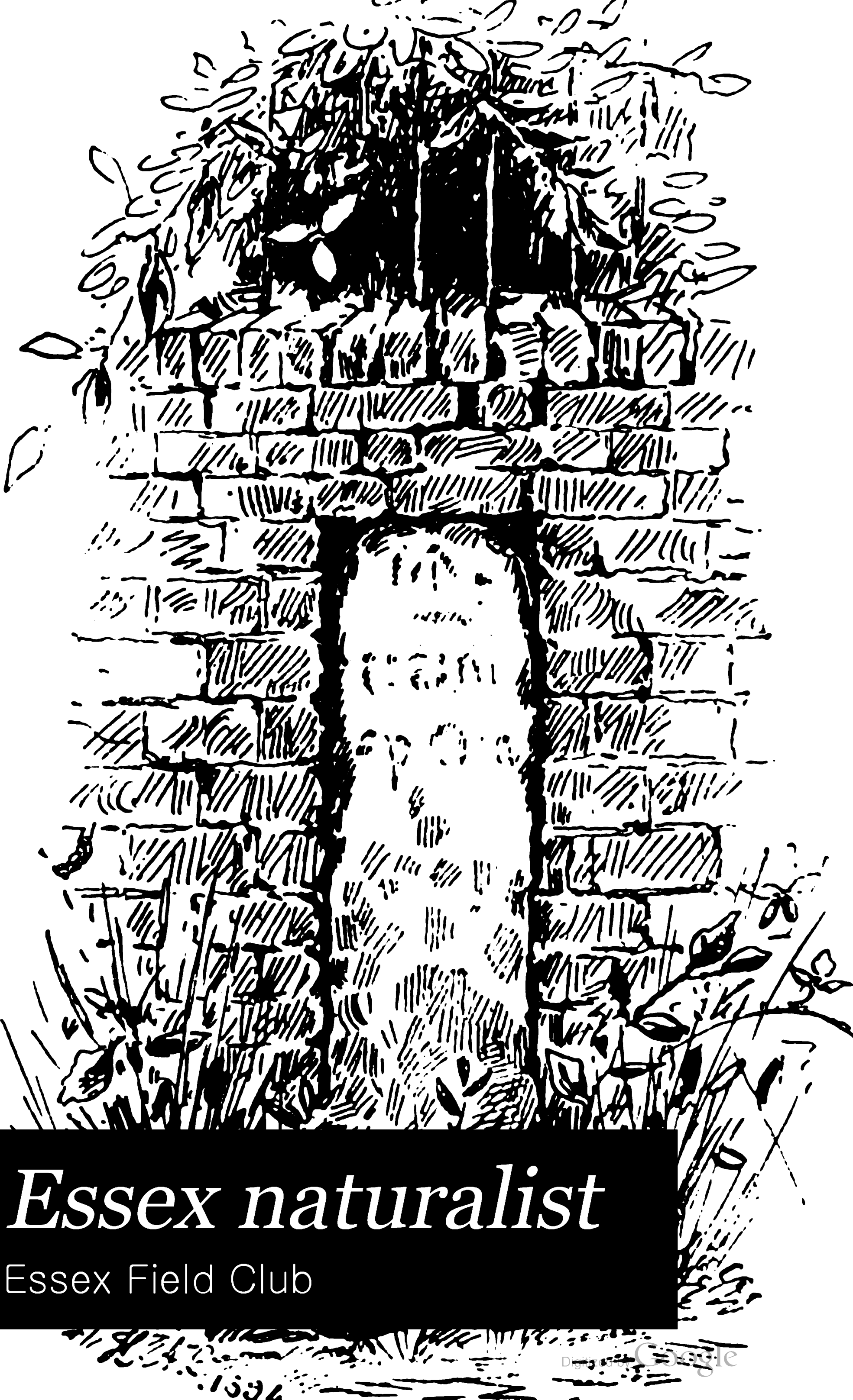

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WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary.

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"*Men that undertake only one district are much more likely to advance natural knowledge than those that grasp at more than they can possibly be acquainted with. Every kingdom, every province, should have its own Monographer.*"—GILBERT WHITE of Selborne.

"*Seldom was ever any knowledge given to keep, but to impart; the grace of this rich jewel is lost in concealment.*"—BISHOP JOSEPH HALL.

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"I wrote the past in characters
Of rock and fire the scroll,
The building in the coral sea,
The planting of the coal."
EMERSON'S "Song of Nature."

"Knowledge this man prizes best
Seems fantastic to the rest:
Pondering shadows, colours, clouds,
Grass-buds and caterpillar shrouds,
Boughs on which the wild bees settle,
Tints that spot the violet's petal."
EMERSON'S "Wood-Notes."

"It would be much if I could persuade some few working naturalists to lay aside their technical lists and records of parish distribution, and study the works of Nature with open eyes, seeking above all things to know more of life in its infinitely varied forms.'
PROFESSOR MIALL, F.R.S

"And what an opportunity is lost in that strangely prevalent mania of childhood—the rage for collecting. To take only eggs and coins, what would not systematic oversight, encouragement and adult scientific assistance do for the development of the great biologist and historical numismatist, if only the incipient taste and industry were grasped in the day of their susceptible youth, and judiciously guided into the adult capacities of manhood. But here, as everywhere, the primary has become the secondary, and it is the latter we cultivate. For while we devote hours to teaching the principles of biology out of books, the innate taste which leads a child to study animal life at first hand is either left to work out its own education, or at best looked upon curiously, and rewarded with the casual praise reserved for an amiable hobby."

"Modern Ideals of Education," by W. K. HILL, in "Contemporary Review," October, 1896.

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Erratum.

Bottom line on p. 200, insert *cinereus* immediately after the word *Thamnotrizon.*

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WILLIAM COLE,

Honorary Secretary.

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⁂ Several articles and the "Notes" are unavoidably postponed until next Number.

The authors alone are responsible for the statements and opinions contained in their respective papers.

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PROFESSOR R. MELDOLA, F.R.S., F.R.A.S.

BY THE ESTABLISHMENT of the Essex Field Club it was intended to band together those taking an interest in Natural Science, residing within or near the borders of the County, and by the establishment of one or more Local Museums, to gather authentic sets of specimens for the use of Students, as well as to create and foster a taste for the out-of-door study of Nature. It was also desired that the PUBLICATIONS of the Club should in time comprise a body of fact and inference, useful to the local and scientific student, as well as interesting to the ordinary reader.

The ORDINARY (SCIENTIFIC) MEETINGS are held about once a month during the autumn, winter, and early spring, in various centres and larger towns in Essex, for the reading of papers, notes, etc., and the exhibition of specimens, especially such as may be of local interest.

FIELD MEETINGS are arranged during the summer months, and held in various parts of the County under the guidance of experienced Naturalists, Geologists, and Archæologists.

The Club has carried on several SPECIAL INVESTIGATIONS—*e.g.*, the examination of the two EPPING FOREST CAMPS, an EXPLORATION of the DENEHOLES, the "RED-HILLS," etc., and has published several valuable REPORTS, illustrated with plans and maps. Considerable efforts have been made to catalogue the Fauna and Flora of the county, and it is wished to extend this work, particularly in the direction of a systematic Exploration for Marine and Estuarine forms, by DREDGING, etc., if sufficient funds can be obtained. None but those who have paid special attention to them can be aware of the wide field for research in the above-named departments of knowledge which the County affords; and the rapid changes effected by the operations of agriculture and the increase of buildings, render it the more necessary that the work should be at once done, and the results recorded.

THE
ESSEX NATURALIST:
BEING THE
Journal of the Essex Field Club
FOR 1895.

THE EASTERN BOUNDARY STONES OF THE FOREST OF WALTHAM.

By RAPHAEL MELDOLA, F.R.S., *Pres. Ent. Soc.*, *Permanent V.P. Essex Field Club.*

IN the spring of 1894, the Rev. S. Coode Hore, Curate of Navestock, called my attention to a stone, rather like a mile-stone in appearance, standing in a corner of a piece of open land, marked in the maps as Curtis Mill Green (see Fig. 1).[1] As the stone was remote from any public road, and did not correspond in position with any parish or other boundary, it occurred to me that it might be one of the boundary stones of the Forest of Waltham referred to in the Perambulation of the reign of Charles I. At the time of our first visit we had with us only the one-inch maps, old and new, and as the stone was not entered in these we had no means of checking my suggestion, since no inscription of any kind could be detected on the stone in the light in which we viewed it. A subsequent inspection of Carey's "Map of the Country Fifteen Miles round London" (1786), showed, however, that my surmise was correct, and that we had discovered the stone referred to as "Richard's Stone" in the Perambulation, and entered as such in Carey's map. As I was not prepared for the possibility of any of these stones being still in existence, the discovery gave an impetus

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[1] The five pictures of the stones are reproduced from drawings made on the spot in June, 1894, by Mr. H. A. Cole, who has presented them to the Club, and we are indebted to Prof. Meldola for defraying the cost of the process-etching.—ED.

A

to further search, and the results are submitted in the present paper. At the meeting of the Essex Field Club, on July 28th, 1894 (see vol. viii., p. 217), the members were taken to see this stone, the history of the discovery of which was given on the spot by the writer.

It will add to the completeness of this account if the history of the Perambulation of 1641, is here briefly set forth. It appears that prior to this period the king had found it to his advantage to afforest as much land as possible, because the enforcement of the

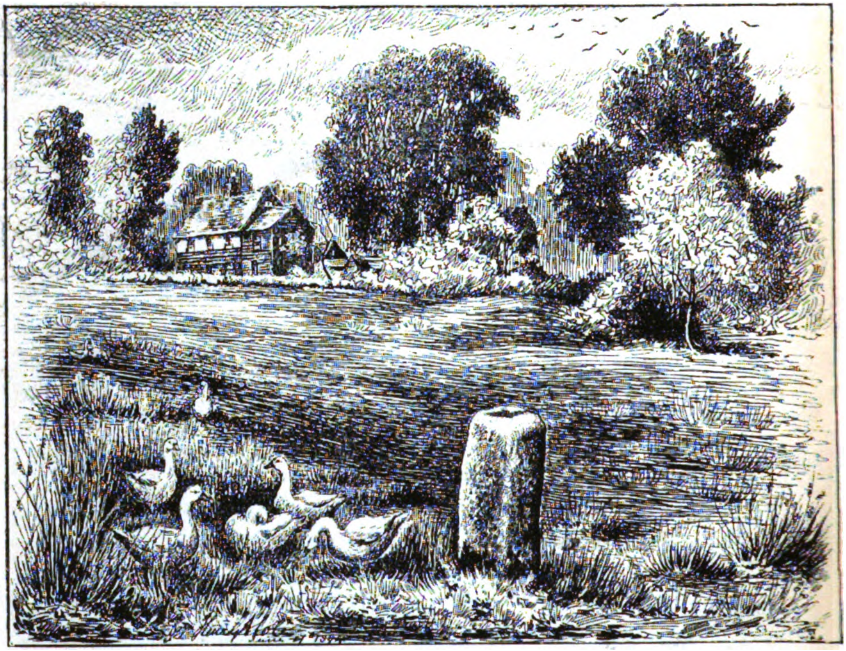

FIG. 1.—"RICHARD'S STONE" ON CURTIS MILL (OR COURTMILL) GREEN, ONE OF THE OLD BOUNDARY MARKS OF THE FOREST OF WALTHAM.

Forest Laws added considerably to the Crown revenues. The extension of Royal Forests all over the country was attempted to an extent that led Strafford to state in a letter:

> "The Justice Seat in Essex hath been kept this Easter week, and all Essex has become Forest; and so they say will all the Counties in England but three—Kent, Surrey, and Sussex." (Letters, I., 413. Quoted from Fisher's "Forest of Essex," note to p. 46).

In 1640 when large sums had been raised, "it is said by Ranke that in Essex alone they amounted to £300,000" (Fisher, *loc. cit.* p. 48), the king began to withdraw:

> "On the 16th March in that year, being just four months after the meeting of the Long Parliament, the Earl of Holland signified to the House of Lords, that the King had commanded him to let them know 'that His Majesty, understanding that the Forest Laws are grievous to the Subjects of this Kingdom, His Majesty out of his Grace and Goodness to his People, is willing to lay down all the new Bounds of his Forests in this Kingdom; and that they shall be reduced to the same Condition as they were before the late Justice Seat held'" (Fisher, *loc. cit.*, pp. 48, 49).

It thus appears that the object of the Perambulation of 1641 was to restore the bounds of the Forest of Waltham to what they were in the twentieth year of James I. This information was obtained upon oath from twenty-five witnesses who were examined by the Commissioners in the presence of the Steward, Regarders, and Sub-Rangers of the Forest at a Court of Inquiry held at Stratford Langthorne on Sept. 8th, in the 17th year of Charles I. The full text of the Perambulation is reprinted in THE ESSEX NATURALIST (Vol. vi., p. 12) as an appendix to a paper by Mr. William Cole, the Hon. Secretary of the Club, and to this the reader is referred for further particulars. It will be gathered from the text referred to that the north, west, and southern limits of the Forest were fixed by natural or artificial boundaries already in existence, such as the River Roding, Purlieu Banks, the River Lea, and the great Essex (Roman) Road to Ilford and Romford, as shown on the sketch-map (Fig. 2), which has been reproduced, with additions, from Fisher's "Forest of Essex." On the east side, however, no such well-defined limit existed, and it is presumably for this reason that the stones were set up. Seven of these stones are mentioned in the Perambulation, and it is of great interest to the writer to be able to state that six of them have now been discovered and identified beyond question, viz., Richard's Stone, Navestock Stone, Park Corner Stone, Mark's Stone, the Warren Stone, and Havering Stone. In addition to these, another stone, not referred to in the Perambulation, but entered in Carey's Map as "Forest Bounds Stone," has been found in Whalebone Lane opposite the house known as "Paulatim Lodge." I propose now to place upon record the details of the search for and discovery of the various stones mentioned.

Soon after the discovery of Richard's Stone, Mr. Coode Hore, guided by Carey's map and the text of the Perambulation, succeeded after much inquiry in finding the Navestock Stone about half-a-mile

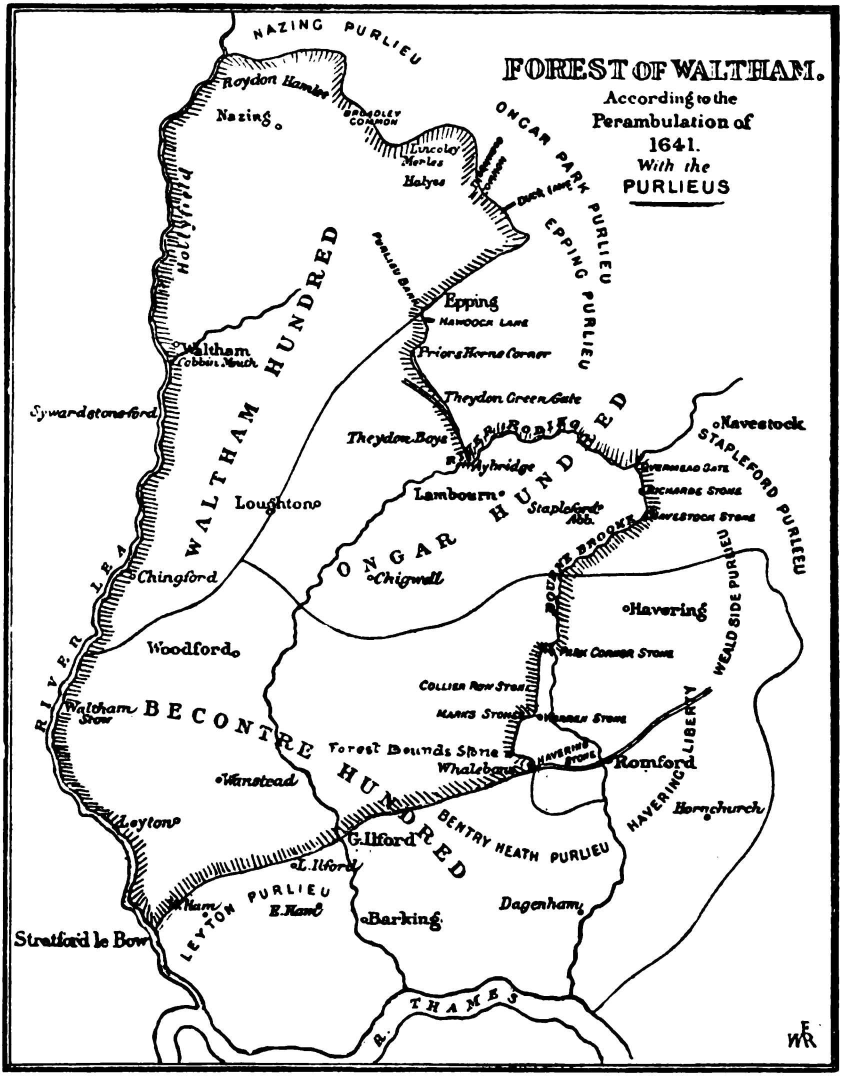

FIG. 2.—SKETCH-MAP OF THE FOREST OF WALTHAM, SHOWING THE POSITION OF THE SEVEN BOUNDARY STONES ON THE EASTERN SIDE BETWEEN THE ROMFORD ROAD AND OVERMEAD GATE. (*From Fisher's "Forest of Essex," with additions.*)

south of Richard's Stone in the garden adjoining the house occupied by Mr. Reynolds (Fig. 3). It had been placed by the Bourne Brook, and had become almost buried by subsidence in the alluvium, but Mr. Reynolds had it cleared by the time of the Club's visit on July 28th, 1894, and some of the members found time to go over and inspect it. Like Richard's Stone, it is oriented with its corners directed towards the cardinal points of the compass. No trace of any inscription could be made out on the portion of the stone exposed to view. Richard's Stone also is much weathered, but at the meeting of the Club referred to, Mr. Glenny, Vice-Chairman of the Essex County Council, happening to catch the face of the stone in a more favourable light than I had first seen it, managed to make out the figure 2 and afterwards the 6 belonging to the date 1642. Everything else has been weathered away.

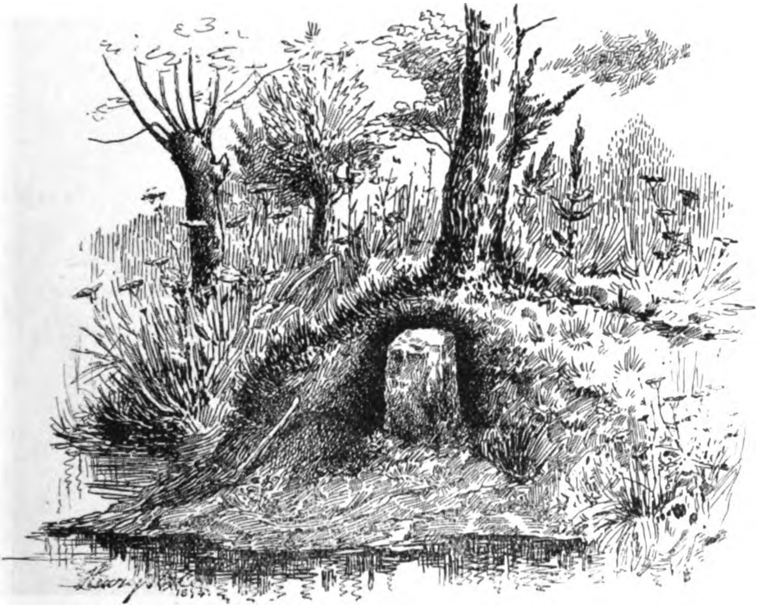

FIG. 3.—NAVESTOCK BOUNDARY STONE, IN THE BANK OF THE BOURNE BROOK.

Since the time of the first identification of Richard's Stone, and in conjunction with Mr. W. Cole and his brothers, Messrs. B. G. and H. A. Cole, I have made several perambulations of the eastern boundary of the old Forest of Waltham with the object of finding the missing stones. On our first visit to the southern end of the boundary we found an old and weather-beaten stone low down in a ditch and let into the brick wall at the eastern end of Whalebone House facing the Romford Road. The only letters decipherable

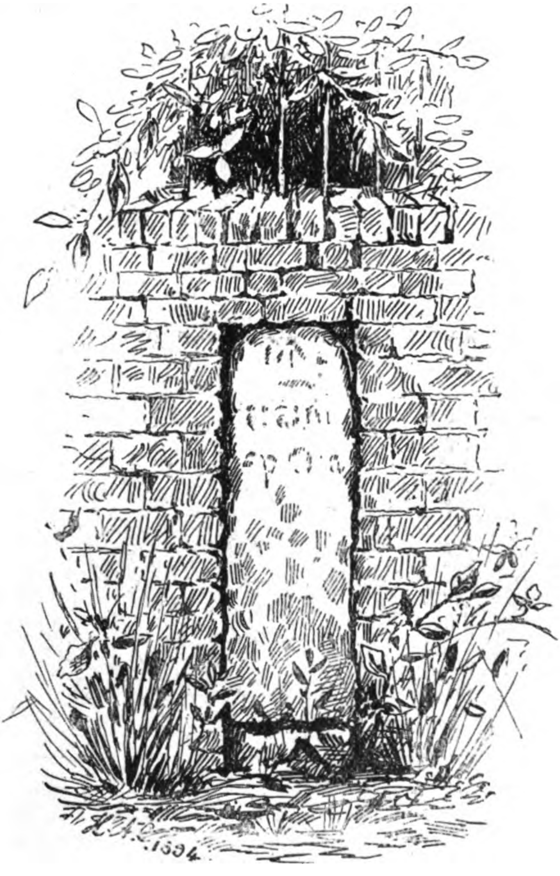

FIG. 4.—HAVERING STONE, BUILT INTO A WALL NEAR THE WHALEBONE HOUSE ON THE ROMFORD ROAD.

were SEPT, but our information was not at the time sufficiently precise to enable us to feel certain that this was the Havering Stone which stood at the corner of the "Beames Land Lane" of the Perambulation. When, however, on a subsequent occasion we found the other stones with the full inscription "Sept. 8th, 1642"[2] we knew that this was in fact the Havering Stone, and the "Beames Land Lane" of the text figures under the more gruesome name of Cut-throat Lane in the modern six-inch Ordnance Map. No trace of this lane now exists, but it is probable that its junction with the Whalebone Lane was at the point where the Forest Bounds Stone, opposite

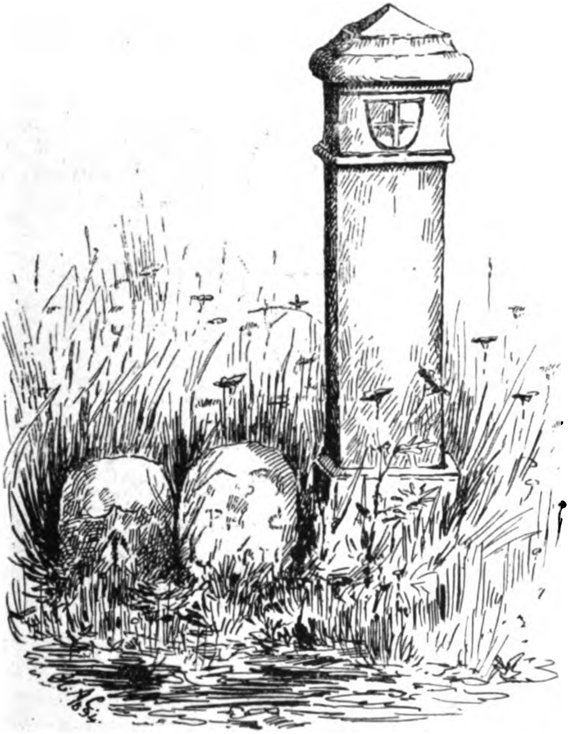

Fig. 5.—Forest Boundary Stone in Whalebone Lane.

Paulatim Lodge, now stands (Fig. 5). It was with the greatest regret that on April 12th of the present year I found that the ditch in front of Whalebone House had been filled in to the level of the road, and the Havering Stone buried out of sight. Mr. H. A. Cole fortunately had secured a sketch of it last year.

---

[2] It is to be noted that the stones are dated a year later than the Perambulation. It is possible that the sites were fixed on September 8th, 1641, and the stones, which would naturally take some time to shape and inscribe, set up on the corresponding date of the following year.

The search for the other stones was facilitated by the fact that two of them, viz.: Mark's Stone and the Warren Stone, are entered on the six-inch Ordnance Map. This is to be attributed to the circumstance that these stones are also Parish Boundaries, or have been made use of as such. On July 24th, 1894, we found Mark's Stone (Fig. 6), and knowing from the map where to look for the Warren Stone, we soon discovered that it had been removed. After some inquiry we found the missing stone broken off at the base and lying in a ditch by the side of the field near where it had stood.

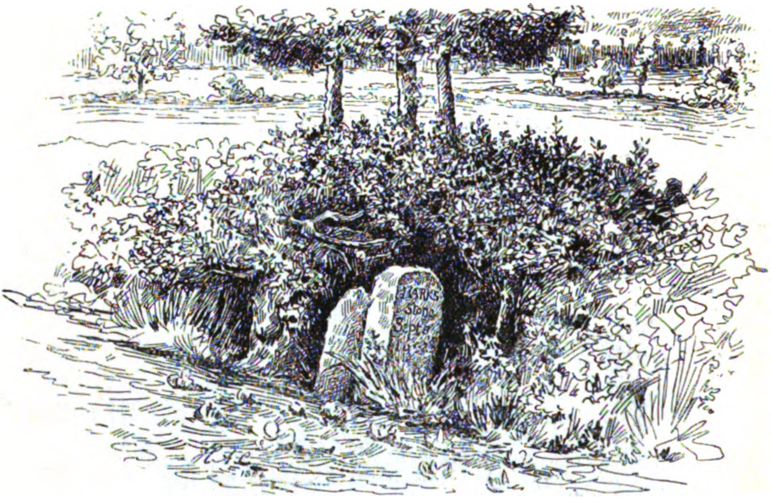

FIG. 6.—MARK'S STONE IN WHALEBONE LANE, ONE OF THE OLD BOUNDARY STONES OF THE FOREST OF WALTHAM.

The inscriptions on both these stones are quite distinct and legible; it is almost certain that they have been re-inscribed since 1642, or else they must be newer stones which have been placed on the site of the original ones.

In support of the latter hypothesis it may be mentioned that an old and weathered stone, almost completely buried, lies alongside of the present Mark's Stone. This view is also favoured by the fact already recorded that the inscriptions on Richard's Stone and the Navestock Stone have become practically obliterated. The inscription on the Havering Stone also has almost disappeared. On referring to the text of the Perambulation, it will be seen that each stone is described as being "sculptured and inscribed," so that, unless there were some special reason for re-inscribing or replacing the stones, it is improbable that the inscriptions on Mark's and the Warren Stones should have withstood the weathering of two centuries and a-half, better than those of their companion stones.

Continuing northward, the next in order, was Collier Row Stone, and then the Park Corner Stone. The former, in spite of many visits and inquiries, has not yet been found. The latter was searched for unsuccessfully at first by Mr. R. Foxall of Noak Hill and myself in the autumn of 1894, although inquiries in the neighbourhood elicited the information that there was an old stone lying in a ditch by the side of a field adjoining a farm on the Havering Park Estate. This stone was subsequently found by my friend, Mr. Foxall, and on April 12th of this year, I went to inspect it in his company. Like the Warren Stone it lies prostrate in a ditch; it has not been broken off at the base but simply overturned, or removed bodily from its site. An old man who had worked on the land nearly all his life, and who first told us where to look for the stone, stated that it had lain in its present position as long as he could remember, and during the period covered by his recollection had never been erect. It is impossible, therefore, to surmise whether it is on its original site or not, since the land has been so much cultivated in this district, that the ancient boundaries are lost and Hainhault Forest has been cleared away completely from the neighbourhood adjoining Havering Park. It is certain that the Park boundary extended further west in the time of the Perambulation. The stone is somewhat damaged by chipping away from the top, but the letters ORN STONE are still distinctly legible.

The fragment of local history thus recovered seems to me to appeal to the interest of the members of the Essex Field Club with sufficient force to make it worthy of record in these pages. It is almost romantic now to consider that the great stretch of Forest to the east of London began "at the Bridge of Stratford called the Bow," and that the little patch of common-land and woodland in the extreme north-east corner now called Curtis Mill Green is an outlier of this Forest which can have undergone but little change since the time of Charles I., while all the intervening expanse of Hainhault Forest has been grubbed up with the exception of a few patches about Lambourne End and Chigwell Row. In conclusion I can only express the hope that the old landmarks now identified will be preserved with all the respect to which their history entitles them and that the owners of the land on which the prostrate stones once stood, will take steps to have the latter set up, and protected in future from all chance of damage by agricultural operations.

NOTES ON THE GEOLOGICAL SECTION AT CHELMSFORD, IN WHICH MAMMOTH AND OTHER REMAINS WERE DISCOVERED IN NOVEMBER, 1894.

By T. V. HOLMES, F.G.S., *Vice-President.*

[*Read March 9th, 1895.*]

AT the meeting of the Essex Field Club at Chelmsford on November 24th, 1894, the lower jaws of a Mammoth (*Elephas primigenius*), which had been found a few days before in a brick-pit belonging to Mr. Brown, were exhibited. It was then too dark to allow of a visit to the pit, but on November 29th I was enabled to inspect it, and fortunate enough to secure the company of Mr. E. T. Newton, of the Geological Survey, who kindly offered his services in determining the species of any mammalian remains found therein. Mr. W. Cole kindly met us at the railway station, and conducted us through the Recreation Ground to the required spot.

The railway south of Chelmsford Station has a general N.N.E. and S.S.W. direction. On the map of the Geological Survey (I.N.E. Drift Edit.) the words "Brick yards" may be seen a few yards south of the spot at which the River Can crosses the railway. The pit in question is just where the *a* of "yards" appears, on the western side of the railway embankment, rather more than half a mile southward of Chelmsford Station. It is in the series of deposits called by the general name of "brick-earth," from their most important constituent, which extend from the junction of the River Can with the Wid, on the west, to Moulsham on the east, a distance of about a mile and three-quarters. The average breadth of ground covered is about a quarter of a mile. A deposit of similar character is shown west of the Wid at Widford, but none has been noted anywhere else in the vicinity of Chelmsford.

A general glance at the map of the Geological Survey shows that west and north of Chelmsford the country consists of a plateau capped by Boulder Clay and intersected by valleys, in which the sand and gravel of the Glacial Period, which underlies the Boulder Clay, appears. Here and there in these valleys may also be seen London Clay, the oldest formation anywhere visible within a radius of more than a dozen miles round Chelmsford. East of that town, towards Maldon, there is a considerable tract of Glacial Gravel uncovered by Boulder Clay, and south of it the highest ground is capped by outlying patches of Bagshot Beds, Boulder Clay, or Post-Glacial Gravel.

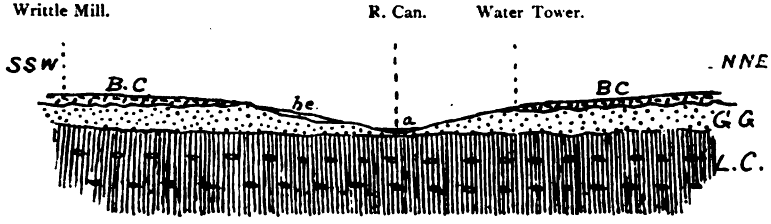

Diagram Section across the Valley of the River Can below its Junction with the Wid. (*Length about 1½ miles.*)

L.C.—London Clay ; G.G —Glacia Gravel ; B.C.—Boulder Clay

a.—Alluvium } River Deposits.
b. e.—Brick-earth }

But besides the beds just mentioned there are certain strata confined to the various river valleys and consisting of deposits of gravel, sand, brick-earth, and alluvium, the material composing which has been brought down by the streams themselves from the higher parts of their valleys. It is evident that, as regards these valley deposits, we shall almost invariably find that the higher their position above the stream the older they are, the highest having been formed when the valley had been but slightly excavated, the lower when its present depth had been more nearly attained.

At and west of Chelmsford the Geological Surveyors have mapped no river deposits but the brick-earth already mentioned and the marsh alluvium on the banks of the present streams. The Glacial Gravel appears to occupy the space between the Boulder Clay capping the plateau and the alluvium at the bottom of the valley, except where the brick-earth lies between them and rests presumably on the Glacial Gravel. The highest point at which the brick-earth is seen is about 100 feet above ordnance datum, and 20 feet above the alluvium of the marshes.

The surface of the ground at the spot where the Mammoth's jaws were discovered in Mr. Brown's pit, is between 90 and 100 feet above ordnance datum. The section[1] there consisted of:

	FEET.
Soil and very fine gravel, about	2
Yellowish brick-earth with a few pebbles here and there	4
Darkish loam with pebbles, ...	1
passing downward into Ferruginous Gravel (coarse), up to	2
Compact slate coloured sandy clay, with here and there small pebbles of chalk	7 seen.

We were told by the workmen that the jaws of the mammoth had been found in the ferruginous gravel overlying the slate-coloured sandy clay, a statement confirmed by their yellow-stained appearance when exhibited at the evening meeting of the Essex Field Club.

Some account of this brick-earth is given in Mr. Whitaker's *Geological Survey Memoir* on "The Geology of London and of Part of the Thames Valley," vol. i., pp. 452-3. Mr. H. B. Woodward has there drawn two sections illustrating the great irregularities in its bedding and composition. And the late H. W. Bristow has given the details of a section "at one of the large brickyards east of the railway," the lowest bed in which consisted of a "pale bluish sandy clay, with small pieces of chalk, etc.," in which the bones of *Hippopotamus* had been found. This deposit is evidently much like the lowest bed seen by us in Mr. Brown's pit west of the railway.

As to the age of this brick-earth, Mr. Woodward remarks that though its relation to the Glacial Gravel is not clear, yet that "from the absence, in sections of that gravel, of any similar brick-earth, and from the position of the deposit, it seems best to regard it as Post-Glacial"

And, indeed, I think that all the available evidence favours the view that it is Post-Glacial, or, in other words, simply a river-deposit newer than the Chalky Boulder Clay. For while, as Mr. Woodward remarks, sections in the Glacial Gravel have never shown any similar brick-earth, it is very common as a river-deposit, and it appears to me to exist just where we might expect, if anywhere, to see a river-deposit of the kind. For, west of Chelmsford, seven streams of various sizes unite to form the Can, which, below its junction with the Wid, flows with a course nearly west to east. But at Moulsham the Chelmer, the largest of the streams which collectively form the river known by that name below Chelmsford, joins the Can, its course above the junction being nearly north to south, or at right angles to that of the Can. When these streams were in flood the natural result of this disposition of the river-valleys would be that the flow of water from the Can and its tributaries would be checked by that of the Chelmer running from north to south. This would cause an unusual amount of flooding and deposition in the valley of the Can above the junction with the Chelmer, or, in other words, just where the brick-earth now exists.

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[1] Though the section *seen* was as above stated, I am indebted to Mr. W. M. Webb for pointing out that at one time there must have been seven or eight feet more brick-earth at the surface, as seen in adjacent pits where it is now worked.

Then, we have seen that the sandy clay forming the lowest bed of the brick-earth contained small pebbles of Chalk, both in the pit we visited and in that seen by the late H. W. Bristow. Mr. Woodward does not appear to have seen any, and his opinion as to the age of the brick-earth is consequently much more guarded than it would otherwise have been. Now, the various streams mentioned all rise within the Tertiary area and traverse country the surface of which consists chiefly of Chalky Boulder Clay. Therefore, it can hardly be doubted that these pebbles of Chalk have not been derived directly from that formation, but are the result of the erosion of the Chalky Boulder Clay, through which the valleys of the various streams have been cut. The occurrence of these Chalk pebbles in the brick-earth consequently implies the prior existence of the Chalky Boulder Clay. Then, while the Boulder Clay has been so deposited that we find it to consist of stones of the most varied age and composition, shape and specific gravity, dispersed irregularly through a more or less clayey matrix, the only pebbles in the sandy clay at the base of the brick-earth are small and of one specially light material, Chalk, and imply selection through the sorting action of running water.

It may be worth while, in view of the importance attached by some geologists to the determination of the horizon of the Mammoth, to say a few words on the curious alternations of very regularly-bedded strata with thin, irregular beds of other material, as a characteristic, not merely of these Chelmsford deposits, but of river-deposits in general. In this case, as in many others, we find that the fine, compact, sandy clay towards the base of the section bears every sign of tranquil deposition, while the overlying gravel occurs in thinner and much more irregular beds. It would seem that at Chelmsford, when the brick-earth was deposited, the rivers there tended, when in their normal condition, to throw down very fine gravel, sand, and mud. But when floods of unusual magnitude occurred, coarse gravel would be spread here and there on the finer sediments, to be in its turn again covered by sand and mud. And the ways of rivers in flood have recently been so singularly well-illustrated in the case of the little stream called the Ravensbourne, which flows, like the Chelmsford rivers, through a Tertiary district, that it seems worth while to give some account here of the changes in it resulting from the heavy rains of last November (1894).

For about a mile of its course the Ravensbourne flows through the Lewisham Recreation Ground, and its banks there have been so regularly turfed and sloped that the effects of the floods could be seen with an accuracy that could hardly have been exceeded had the stream been modified simply with a view of demonstrating their results. In its normal state the little stream brings down and deposits nothing but sand and mud. Its breadth averages about 20 ft., and the alluvial flat through which it runs at the Recreation Ground has a level from 5 to 6 ft. about the average height of the water. Here and there, where horseshoe-like bends occur, a shorter channel has been made, and the peninsula enclosed by the bend converted into an island. These islands seldom exceed 20 yds. in length and are of less but variable breadth.

A slight embankment prevents the ground from being flooded, though the floods which everywhere prevailed in November (1894) so swelled the stream that the alluvial flat would otherwise have become covered with water. When the floods subsided, the trimness of the sloped and turfed banks allowed their effects to be demonstrated with singular precision. Here and there sand in varying amount might be seen on the grass as high as the edge of the alluvial flat, and the tops of the islands. But the most curious alterations appeared in the channels of the stream where alternative courses existed. In one case (Diagram A) a very considerable mass of coarse gravel, covered by sand and vegetable refuse, had been deposited at the mouth of the old course, and a smaller amount of sand and vegetable matter could be seen thence downwards, as far as its junction with the new cut. In another case (B) where the channels on each side of the island were nearly equal in directness, the floods seem to have at first preferred as a main channel the course which afterwards became a back-water. A considerable mass of gravel might be seen from the upper mouth of this channel to a spot about half way between the two ends of the island, separating this channel from the alternative one. This gravel was covered by sand at a spot where the current had not been very strong, and increased in thickness towards the spot at which it abruptly ended in an almost vertical bank half way between the ends of the island. So much gravel had apparently been piled up in this channel during the earlier part of the flood's duration that the result had been to make the other the main course at a later period. In the case of other alternative channels, more or less coarse gravel was to be seen at the mouths of those which had not been the main channels of the flooded stream. And in all these cases the coarse gravel will some day be covered by the sand and mud which is the normal deposit of the Ravensbourne at Lewisham, unless the conservators of the Recreation Ground modify the natural results. In short, the Ravensbourne is making deposits to-day in a way precisely analogous to that of the Chelmsford streams in the days of the Mammoth.

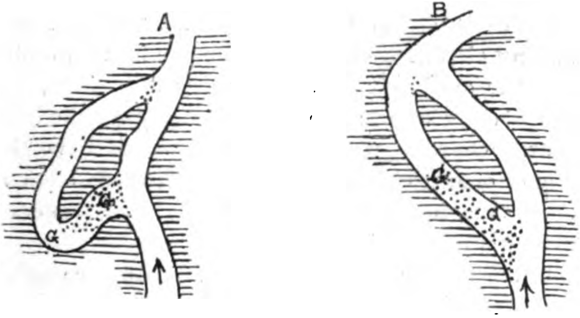

DIAGRAM PLAN TO ILLUSTRATE THE EFFECTS OF THE RECENT FLOODS IN THE RAVENSBOURNE AT LEWISHAM.

G.G.—Gravel, sand, etc., deposited by the Floods. ■→ Direction of the flow of the stream.

And this brief consideration of the effects of floods in the Ravensbourne, enables us to understand why the Mammoth at Chelmsford became deposited in the coarse gravel. Carried down the flooded stream, its carcase would naturally be deposited with the gravel at the entrance to some back-water, and be covered up by the finer material constituting the more normal deposits of the streams in that locality. Only in times of flood can we imagine these streams capable of carrying down a Mammoth, and of ultimately drowning him. But the most powerful animal might easily exhaust himself in unavailing struggles to get out when he found himself carried away by the torrent. Similarly, no doubt, perished the elephants mentioned by Sir Samuel Baker in his *Nile Tributaries of Abyssinia* (Chap. VIII.) where we find the following remarks :

> "August 19. A dead elephant floated down the river to-day: this is the second that has passed within the last few days; they have been most probably drowned in attempting to cross some powerful torrent tributary to the Atbara."

Of the wild elephant of Ceylon, and his love of water, Sir J. Emerson Tennent remarks that "no altitude, in fact, seems too lofty or too chill for the elephant, provided it affords the luxury of water in abundance." We have no reason to suppose that the Mammoth had less love of water than the elephants of Africa and India of the present day.

And it is evident that when we consider the great distance to which existing elephants can swim, the mere breadth of the Atbara or the Chelmer, or of some far mightier river than either, would constitute no danger in itself to one of the most buoyant of all quadrupeds. On the other hand, the immense weight of the Mammoth, or of any other kind of elephant, would often make its emergence from a flooded stream with banks of soft material, a very difficult, or even impossible task.

To this difficulty we doubtless owe the appearance of the dead elephants in the Atbara, and of the Mammoth in the ancient river-deposits of Chelmsford.

NOTES ON THE REMAINS OF PLEISTOCENE MAMMALS FOUND IN THE NEIGHBOURHOOD OF CHELMSFORD.

By E. T. NEWTON, F.R.S., F.G.S.

[*Read March 9th, 1895.*]

SO few remains of Pleistocene Mammals have hitherto been recorded from the Chelmsford district that additional information concerning them is much to be desired. Certain specimens have recently come into the possession of the Essex Field Club for their Museum, from a brick-pit close to the Railway, where the section is exposed which has just been described by my friend and former colleague on the Geological Survey, Mr. T. V. Holmes, and it has been thought well to give some account of these interesting fossils.

So far as I am aware, the only species hitherto known to occur near Chelmsford, are those mentioned by Prof. W. Boyd Dawkins[1] from Moulsham, near Chelmsford, namely *Hippopotamus major*, *Bos primigenius*, and possibly *Bison*. Mr. H. W. Bristow and Mr. H. B. Woodward, as recorded by Mr. W. Whitaker,[2] when noticing the occurrence of *Hippopotamus* at Moulsham, probably allude to the specimens referred to by Prof. Boyd Dawkins. The authorities for these specimens are said to be those of the British Museum and the Museum of the Geological Survey.

Mr. R. Lydekker's "Catalogue of the Fossil Mammals in the British Museum" (part 2, p. 280) includes eight specimens of bones of *Hippopotamus* from Moulsham, Chelmsford; but it seems quite possible that these may all have belonged to one animal. In the same catalogue (p. 13) is also noticed, from the same locality, a metatarsal of *Bos taurus* var. *primigenius*. No remains of *Bison* are recorded in these catalogues from near Chelmsford, and a diligent search through the remains of Pleistocene Mammals in the Museum of the Geological Survey has failed to bring to light any specimens from that locality. I am unable, therefore, to verify Prof. Dawkins' record of *Bison* from Chelmsford, and it must still remain as he left it, in doubt. On the other hand the occurrence of *Bos* and *Hippopotamus* is further established by specimens in the Essex Field Club Museum, said to have been obtained near Chelmsford. One of these is a fine femur of *Hippopotamus* in a good state of preservation and nearly perfect; besides this there are two examples of the frontlets and horn cores of a large *Bos* which I should refer to the *primigenius* variety of *Bos taurus*. In addition to these there are in the same Museum two elephant's molar teeth from the Pleistocene, but they are less certainly from this district. One of these is referable to *Elephas primigenius* and the other to *E. antiquus*.

Fortunately the evidence for the occurrence of *Elephas* in the Chelmsford Pleistocene deposits does not rest upon these two specimens, for quite recently a fine lower jaw of *Elephas primigenius* has been discovered in the brick-pit at Chelmsford, in the bed of ferruginous gravel overlying the blue clay, described by Mr. T. V. Holmes, and has been secured for the Essex Field Club Museum. Both rami of this lower jaw are preserved, but the articular portions are wanting. The deep trough, or spout-like symphysis, is well seen. That this jaw belonged to an adult animal is shown by the presence of what appears to be the last molar tooth (M. 3) in place on each side, and having about half of the crown uncovered and worn down, so as to expose the edges of the crenulated enamel plates. The edges of several worn plates may be seen in each tooth; but as the hinder parts are hidden in the jaw the full number of the plates is not known. The width of the tooth, and the comparative narrowness of the plates, agree best with the form of the teeth of the Mammoth, *E. primigenius*, and to this species it is referred.

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[1] *Quart. Journ. Geol. Soc.*, vol. xxv., p. 198, 1869.
[2] *Geology of London*, 1889, p. 452.

The current number of THE ESSEX NATURALIST, vol. viii., p. 155, contains a notice of the discovery of a fine tusk of an elephant in the brickfield near Lower Anchor Street, Chelmsford, which has been presented to the Museum by Mr. James Brown.

Yet another specimen has been secured by the Club from the same pit as the Elephant, namely a part of the lower jaw of a *Rhinoceros antiquitatis* (=*tichorhinus*). This well-preserved specimen is a right ramus and symphysis, with six grinders in place, showing that this animal was likewise fully adult.

The species of Mammals now known from the Pleistocene at or near Chelmsford are as follows, and include some of the most characteristic species of Pleistocene times:

Elephas primigenius.
Rhinoceros antiquitatis (=*tichorhinus*).
Hippopotamus amphibius (=*major*).
Bos taurus var. *primigenius.*

and possibly also

Bos bison (?).
Elephas antiquus (?).

One of the chief points of interest in these remains is the position in which they have been found; for, as pointed out by Mr. Holmes in his paper, this Chelmsford deposit of Brick-earth overlies certain Blue Clay with fragments of chalk, which, it seems, is re-deposited Chalky Boulder-clay; so that, in this locality, the Mammoth undoubtedly lived after the deposition of this Boulder-clay.

The perfect state of preservation of these remains, which is remarkable seeing how near they were to the surface (not more than 6ft.), prevents any idea of their having been derived from pre-existing beds and redeposited, and their perfect condition raises the hope that other equally good specimens will, in course of time, be unearthed; and now that the workmen are aware of their value, greater care will be taken to preserve whatever may be found.

It is highly probable that mammalian bones from the brick-earth of this neighbourhood are preserved in private collections, and, if such be the case, it is hoped that some intimation of their existence may be sent to the Secretary of the Essex Field Club, or to the writer of these notes.

NOTE ON THE SHELLS FROM THE BRICK-EARTH AT CHELMSFORD.

By WILFRED MARK WEBB, F.L.S., *Memb. Malac. Soc.*

[*Read March 9th, 1895.*]

SHORTLY after the meeting of the Essex Field Club on November 24th, 1894, at which the mandible of the mammoth was exhibited, I visited the pit from which it was taken, in the hope of discovering some molluscan remains. The face of the working had been cleaned off provokingly with spades, and a brief search revealed nothing in the way of shells. On the occasion, however, of the visit of Mr. E. T. Newton and Mr. T. V. Holmes, it was found that a large fall had just occurred, and Mr. William Cole who, with the other explorers, went with me on to the heap of *débris*, through which the surface-water freely trickled, was the first to discover a white speck on the freshly exposed surface, which turned out to be a shell of *Succinea*, and was soon followed by other examples.

The shells were almost completely confined to a band of greyer material, generally some two or three inches wide, running horizontally through the browner brick-earth at a distance of about five feet below the present surface. One of the workmen, however, pointed out next day that some nine feet of stuff had been previously taken off, and the marks on the abrupt slope leading to the hedge at the base of the railway embankment and facing the section, bear out the statement. This being so, the shell deposit should be reckoned as existing thirteen or fourteen feet below the original ground level.

As the fall, before alluded to, brought the brink of the pit dangerously near to the tram-rails, and the amount of water present precluded deeper excavations, steps had already been taken to fill up that particular part of the pit. This fact, although it enabled us to dig with impunity, was decidedly tantalising, as in one small spot just here, the shell-bearing layer was somewhat thicker, and was more easily get-at-able in one of the fallen blocks; but it was fortunately possible for me to return during the same afternoon, and then and on the following morning, with the assistance of Mr. Cole, a considerable quantity of grey brick-earth was collected as quickly as possible, before our small excavation was completely buried.

The lumps of this brick-earth, after having been allowed to dry, will gradually fall to pieces when placed in water, producing a remarkably fine and soft mud which, with the exception of the shells and some small hard bodies, consisting of coherent particles and probably produced by worms, will pass easily through muslin.

Up to the present only the following shells have been picked or washed out:

Pupa muscorum, Linn.
Succinea elegans, Risso.
Succinea oblonga, Drap.
Limnaea pereger, Müll.
Limnaea palustris, Müll.
L. truncatula, Müll.
Planorbis marginatus, Drap.
Planorbis spirorbis, Linn.

Want of time has as yet prevented me from working out the whole of the material, and as a considerably quantity still remains to be gone through, while the pit may still produce other species, the list given above must be considered provisional.

THE ESSEX FIELD CLUB.

THE 153RD ORDINARY MEETING.

Saturday, January 12th, 1895.

THE 153rd Ordinary Meeting was held in Grosvenor House, Walthamstow, at 6.30 p.m., Prof. R. Meldola, V.P., in the chair.

Mr. W. Chattaway was elected a member of the Club.

The Secretary announced some very valuable presents to the Central Museum and to the Forest Museum, from Dr. Laver, Dr. M. C. Cooke, Mr. J. J. Powell, Mr. B. Winstone, Mr. Chalkley Gould, and Mr. C. Leaf. Some of these presentations are recorded in the Annual Report of the Council.

He also announced that the Walthamstow Literary Institute had promised to lend specimens of animal remains from the great beds of the River Lea, at

Walthamstow, found during the construction of the reservoirs of the East London Water Company, together with the case containing the specimens.

Cordial votes of thanks were accorded to the donors of these valuable collections, and to the Committee of the Walthamstow Institute for the loan of specimens.

The Secretary exhibited the collection of the Rubi of the Forest, presented by Mr. Powell.

Mr. C. Oldham exhibited a box of Lepidoptera from the Forest.

Mr. Shenstone and Prof. Meldola made some remarks upon the exhibits.

Prof. Charles Stewart, M.A., F.L.S., then delivered a lecture, entitled "Stray Notes on Natural History." The lecture was illustrated by drawings in coloured chalk upon the blackboard, and dealt mainly with the habits of leaf-cutting and fungus-growing ants, and the protective colouring of the common duck, etc.

Prof. Meldola, Rev. W. Linton Wilson, Mr. J. C. Shenstone, Prof. Stewart, and others took part in the discussion which followed.

A cordial vote of thanks was passed to the Professor for his kindness in giving the lecture.

In spite of the exceedingly inclement night (a "blizzard" was blowing) about forty members and friends attended. Tea and coffee were served as usual at the close.

VISIT TO THE GUILDHALL MUSEUM AND LIBRARY.

Saturday, February 16th, 1895.

AN exceptionally pleasant afternoon was spent at the Guildhall, on the kind invitation of Mr. J. Douglass Mathews, F.R.I.B.A., F.S.S. (Chairman of the Library and Museum Committee of the Corporation of London), and Mr. Charles Welch, F.S.A., the Librarian and Curator. The very large party, of over one hundred in number, assembled in the Reference Reading Room, where Mr. Welch had arranged an exhibition of some of the most interesting books and MSS. in the Library.

An excellent account of the Guildhall Library will be found in a pamphlet by Mr. Welch, published under the direction of the Library Committee ("The Guildhall Library and its Work," Lond., 1893). A Library was first established at the Guildhall in the fourth year of Henry VI. (1425), under the bequests of Richard Whityngton and William Bury. The Library was attached to the Ancient College at Guildhall, which had a custos and four priests, and "Maister John Clipstone, Prest and Bedeman, Keper of your Liberary atte Guyldehalle," was the earliest keeper of whom any record exists. This old Library was carefully preserved and made useful to students for over a century, when, as John Stowe relates:—"These bookes (as it is said) were in the raigne of Edward the VI., sent for by Edward, Duke of Somerset, Lord Protector, with promise to be restored shortly: men laded from thence three Carriers with them, but neur returned." No reference to this act of selfish rapacity is to be found in the City records, but it probably happened in 1549.

From this date to 1824 is a long step, but in that year, on the motion of Mr. Lambert Jones, a Committee was formed to establish a library of all matters relating to the city, and in 1828 the library was opened for use, under the control of Mr. W. Upcott. In the next year the books numbered 2,800 volumes—and it continued to grow rapidly. In 1869 it was resolved to erect the present public library and museum, and it was opened by Lord Selborne on 5th November, 1872. Mr. Welch was appointed librarian in 1888, and in 1892 he reported that the library contained 68,369 volumes, and 38,075 pamphlets. These numbers have now largely increased; the library is now a most valuable and interesting one, and exceedingly rich in works on the topography and history of London and its environs.

The museum was commenced in 1846 by the reception of a large collection of Roman antiquities, found during the excavations for the New Royal Exchange in 1841. In 1850 the Beaufoy collection of 17th century tradesmen's tokens were presented, and after the erection of the new buildings the museum grew in importance rapidly, accommodation being found for it in the basement. It now contains most interesting collections of antiquities, illustrating Roman and mediæval London. The rooms in which it is contained, are, however, not well adapted to the purposes of a museum, and it is sincerely to be hoped that one day London may be furnished with a museum building worthy of the greatest city in the world.

Before commencing an inspection of the museum a meeting was held, Mr. Mathews in the chair, who cordially welcomed the Club, and expressed his surprise at so large an attendance of Essex people. Mr. F. Chancellor, as President, cordially thanked Mr. Mathews and Mr. Welch for the kind reception accorded to the Club, and said, referring to Mr. Mathews' remarks, that before the establishment of the Club it would have been difficult to secure the attendance of a dozen people interested in science or archæology from Essex.

Mr. Welch then read a paper entitled, "Notes on the Origin and Progress of the Guildhall Museum."

[This paper, it is hoped, will be published by the Museum Committee, with additions, to form a guide to the museum.]

The party then adjourned to the museum, where, under Mr. Welch's guidance, an hour was pleasantly and profitably spent in examining the exhibits, which represent every era of the city's history, from the times when Palæolithic man wandered over the Thames Valley, leaving evidence of his existence in the flint implements which have been found in London, down to last year, when a medal was struck by the Corporation to commemorate the opening of the Tower Bridge. The work of cataloguing and classifying the vast number of objects has been most skilfully carried on by Mr. Welch and his assistants, and the museum should be better known and more used than it is by frequenters of the City.

On the kind invitation of Mr. and Mrs. Mathews the party then moved into the picture gallery, where tea and light refreshments were dispensed with the hospitality of the City Corporation, amidst the pleasant surroundings of beautiful pictures.

THE 154TH ORDINARY MEETING.

Saturday, March 9th, 1895.

THE 154th Ordinary Meeting was held in a room at the Young Men's Christian Association, West Ham Lane, Stratford, at 6.30 o'clock, Professor R. Meldola, F.R.S., V.P., in the chair.

The first business was the nomination of the Officers and new Members of the Council for the ensuing year in anticipation of the Annual Meeting to be held on

March 30th. These nominations were duly made in accordance with Rule VII. (see Report of Annual Meeting, *infra*, p. 24).

Mr. Cole, as Curator of the Museum, exhibited some specimens of rare Essex Lepidoptera from the Laver Collection recently presented to the Club, including the specimen of *Vanessa antiopa* taken at Middlewick, Colchester, by W. Tillaney, August 29th, 1880, and specimens of *Apatura iris* (one female, taken as it was flying round a moderator lamp in the evening in Colchester town (E.N. vol. v., p. 96), *Liminitis sybilla*, etc., from the Colchester District. Mr. Cole alluded to the interest attaching to the specimens in this collection, in consequence of the increasing rarity of many of the species in this county.

Prof. Meldola exhibited a very remarkable aberration of *Satyrus janira* (the Meadow-brown butterfly) male, taken near Noak Hill, Essex, by himself on July 29th, 1894. Each wing exhibited large pale patches in the discoidal area, more pronounced, perhaps, than in any specimen yet figured in entomological publications. He also exhibited for comparison another specimen, showing the same variation in a less degree, which he took in New Forest some years ago.

Mr. Webb exhibited the living larva of the Stag-beetle (*Lucanus cervus*), dug up a few days ago out of earth at the foot of a tree.

Mr Cole exhibited, on behalf of Mr. H. C. Snell, a stone dug up from a gravel pit, about eight feet down, in Mr. Snell's garden, bordering on Lodge Bushes, Buckhurst Hill, which appeared to exhibit signs of chipping by human agency.

He also exhibited a collection of about twenty specimens of stone implements, cores, flakes, etc., recently presented to the Museum by the Rev. A. W. Rowe, M.A., F.G.S., all from the neighbourhood of Felstead, Essex (these will be noticed more fully later, in "Museum Notes").

Mr. Chalkley Gould exhibited a forest document of the eighteenth century, being a Treasury Order of George II., of the 14th January (O.S.) for the payment of salaries of certain officials of the Forest, which was of very considerable interest as showing the status and duties of of the forest officials at that period. The full text of the Order will appear in THE ESSEX NATURALIST, and Mr. Gould said that he would have much pleasure in presenting the original document to the Epping Forest Museum.

Mr. G. T. Newton, F.R.S., commented npon the small collection of fragments of mammoth and rhinoceros bones presented to the Forest Museum by the Rev. J. W. Kenworthy, and exhibited that evening. The specimens came from a pit near Lea Bridge, Clapton. A fuller report on these specimens will appear later.

Mr. Newton also exhibited and commented upon a series of bones of Vertebrata, being portion of a large collection made by Mr. Lewis Abbott from one of the fissures in the Kentish Rag, near Ightham, in Kent. The species of animals might be divided into three groups: (1) Extinct forms; (2) those which are extinct in Britain, but are still living elsewhere; and (3) species still living in Britain. Mr. Newton made some very interesting observations on the distribution of the forms, and on the probable climate during the Pleistocene period as illustrated by these remains.[1] Mr. Newton also exhibited the skin of an Arctic Lemming, taken by himself in Norway last year.

On the proposal of the Chairman cordial votes of thanks were passed to the exhibitors and donors.

Mr. T. V. Holmes then read a paper entitled "Notes on the Section at

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[1] See paper n the subject by Mr. Newton in "Quart. Journal Geological Society," vol. l. (1894), pp. 188- 09, plates X.-XII.

Chelmsford, in which Mammoth and other Remains were discovered in November, 1894." The paper was illustrated by maps and sections (see p. 10).

Mr. E. T. Newton read, "Notes on the Remains of Pleistocene Mammals found in the neighbourhood of Chelmsford" (see p. 16).

Mr. W. M. Webb, F.L.S., read, "Notes on the Species of Mollusca found in the Pit at Chelmsford where the Mammoth Bones were obtained." He exhibited the specimens upon which the notes were founded (see p. 19).

A discussion ensued, in which the Chairman and the authors of the paper took part. Mr. T. V. Holmes described the nature of the re-deposited Chalky Boulder Clay in the Pit at Chelmsford, and Mr. Webb gave some reasons for believing that some feet of soil had been removed from the upper surface of the section described by Mr. Holmes.

Thanks having been passed to the authors, tea and coffee were served at the close of the meeting as usual.

THE 15TH ANNUAL GENERAL MEETING AND 155TH ORDINARY MEETING,

Saturday, March 30th, 1895.

THE 15th Annual General Meeting of the Club was held in the small lecture room of the Young Men's Christian Association, West Ham Lane, Stratford, at 7 o'clock, Mr. F. Chancellor, President, in the chair.

The minutes of the 14th Annual Meeting, held on March 31st, 1894, were read and confirmed.

The Report of the Council for the year 1894 was read and adopted (see p. 25).

Mr. Crouch, one of the Auditors, read the Treasurer's Statement of Account, which was also received after slight discussion (see p. 27).

At the meeting on March 9th last the following members of the Council retired under Rule IV., but, with one exception, offered themselves for re-election:—

Mr. Miller Christy, Mr. J. T. Mann, Mr. J. C. Shenstone, and Rev. W. C. Howell.

At the meeting on March 9th, the following Members were duly proposed and seconded for ELECTION into the COUNCIL:—Mr. Horace T. Brown, F.R.S., Mr. Miller Christy, F.L.S., Rev. W. C. Howell, M.A., and Mr. J. C. Shenstone.

As OFFICERS for the year 1895, the following were nominated:—*President*, Mr. David Howard, J.P., F.C.S.; *Treasurer*, Mr. A. Lockyer; *Hon. Secretaries*, Mr. W. Cole, F.E.S., and Mr. B. G. Cole; *Librarians*, Mr. E. Durrant and Mr. W. C. Waller, M.A., F.S.A.; *Hon. Counsel*, Mr. C. Browne, M.A., F.S.A.; *Hon. Solicitor*, Mr. H. L. Coburn.

As *Auditor (for Council)*, Mr. Walter Crouch, F.Z.S.; (*For Members*), Mr. J. D. Cooper.

No other members having been proposed, the above gentlemen stood elected by Rule VII. as members of the Council and Officers for the year 1895, and were so declared by the Chairman.

The following therefore constitute the Officers and Council for 1895:—

PATRON.—H.R.H. the Duke of Connaught and Strathearn, K.G.

PRESIDENT.—David Howard, J.P., F.C.S.

PERMANENT VICE-PRESIDENTS.—(*Under Rule IV.*)—Prof. R. Meldola, F.R.S., F.R.A.S., F.E.S, &c. (*President* 1880–82); Prof. G. S. Boulger, F.L.S., F.G.S. (*President* 1883–84); T. V. Holmes, F.G.S., M.A.I. (*President* 1885–87); E. A. Fitch, F.L.S., F.E.S. (*President* 1888–91); Dr. Henry Laver, F.L.S., F.S.A. (*President* 1892); Frederic Chancellor, J.P., F.R.I.B.A. (*President* 1893–94).

OTHER MEMBERS OF COUNCIL.—John Avery, C.A.; Rev. R. E. Bartlett, M.A.; C. E. Benham; Horace T. Brown, F.R.S., E. N. Buxton, J.P., Aldmn. C.C., D.L., &c.; Miller Christy, F.L.S.; Walter Crouch, F.Z.S.; Bryan Corcoran; L. Cranmer-Byng; George Day, F.R.M.S.; F. W. Elliott; A. J. Furbank; I. Chalkley Gould; Andrew Johnston, Chm. C.C., J.P., &c.; Rev. W. C. Howell, M.A.; Rev. W. S. Lach-Szyrma, M.A.; J. H. Porter; Right Hon. Lord Rayleigh, F.R.S.; J. C. Shenstone, F.R.M.S.; John Spiller, F.I.C., F.C.S.; J.C. Thresh, D.Sc., M.B.; F. H. Varley, F.R.A.S.; T. Hay-Wilson; Rev. W. L. Wilson, M.A.

HON. TREASURER.—Alfred Lockyer.

HON. SECRETARY AND DIRECTOR.—William Cole, F.E.S.; ASSISTANT HON. SECRETARY.—B. G. Cole.

HON. LIBRARIANS.—Edmund Durrant and W. C. Waller, M.A., F.S.A.

HON. COUNSEL.—Charles Browne, M.A., F.S.A.; HON. SOLICITOR.—H. I. Coburn.]

Mr. Chancellor then delivered his ANNUAL ADDRESS, which dealt with the proceedings of the Club during the past two or three years, and largely with the work of the Scientific Sub-Committee of the County Council on Technical Education (see p. 30).

A vote of thanks to Mr. Chancellor for his Address and services as President of the Club during the past year was proposed by the President-Elect, Mr. D. Howard, seconded by Prof. Meldola, and carried unaminously. Both the proposer and seconder made some valuable remarks upon the subject of Technical Instruction as carried out in Essex.

Mr. Chancellor briefly replied.

A vote of thanks was also passed to the Officers of the Club.

At the Ordinary Meeting (the 155th) the following were elected members of the Club: Mr. J. Bird, Mr. Bruce Cook, and Mr. George H. Morris, Ph.D.

The meeting concluded with the usual service of light refreshment.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31ST, 1894.

[*Read and adopted at the Annual Meeting held at Stratford, March 30th, 1895.*]

IN presenting the 15th Annual Report, the Council is in a difficulty similar to that which obtained last year. Three or four of the most important matters engaging the attention of the Council are still in progress, and they are not yet ripe for full information being given with respect to them. The membership roll, and the publication of two "Special Memoirs" may be instanced. These will form the subjects of separate reports as soon as decisions have been arrived at upon them.

FINANCIAL.—The financial position of the Club shows but little change as compared with former years, being still far from satisfactory. A few small economies will be effected during 1895, but with two museums to maintain and an annual volume of THE ESSEX NATURALIST to produce, much cannot be expected in the direction of a reduction of expenditure. A more regular and punctual payment of subscriptions would do much to increase the club's efficiency, and the Council earnestly appeals to those members, who are in fault, to discharge their obligations with greater promptitude henceforward.

MEETINGS IN 1894.—It is pleasanter to refer to the success of the ten meetings of last year. The Annual Meeting was held on March 31st, at which Mr. Chancellor delivered a valuable address upon the development of architecture in Essex, which has been printed in full in THE ESSEX NATURALIST. At a meeting at Walthamstow on February 3rd, Professor Meldola gave a lecture upon the scientific applications of photography, a full abstract of which has been published in our journal, and which attracted considerable notice in the photographic press. The meeting for the establishment of the Forest Museum is referred to below. A most important meeting was that held on April 28th for an inspection of the forest, but in view of the verbatim reports given in THE ESSEX NATURALIST (Vol. viii., pp. 52-71 and pp. 117-121), it is unnecessary to enlarge upon it. The meeting on the River Lea on July 14th, at which Major Lamorock Flower gave most valuable services, and that in the Navestock district, when the Rev. Coode Hore and Prof. Meldola most kindly and efficiently conducted, may be mentioned as two of the most successful meetings ever held by the Club. At the latter assembly the members were most hospitably entertained at luncheon at Dudbrook by Mr. and Mrs. Seller, and at the very pleasant meeting in the Colchester district on June 23rd, the party had the pleasure of being received by Mr. James Round, M.P., at his beautiful seat at Birch.

The other meetings are, or will be, reported in THE ESSEX NATURALIST, and in connection with them, in addition to the above acknowledgments, the Council has pleasure in cordially thanking those gentlemen who gave aid in various ways as "Conductors" or "Referees" at the Field Meetings, whose valuable services are duly recorded in the above-mentioned reports.

MEMOIRS READ AND PUBLISHED.—The papers read at the meetings, many of which have already been published, have been of a very interesting and instructive nature, and fully maintain the characteristic features of THE ESSEX NATURALIST as a local journal. As Mr. Batters is not a member of the Club special thanks are due to him for the trouble and skill given to the examination of the Hope collection of Essex Marine Algæ, and the important paper founded on this collection, which was printed in the E.N., vol. viii., pp. 1-25. The Council has to thank our colleague, Mr. J. C. Shenstone, for generously presenting the greater number of the blocks illustrating his paper on the oak tree in Essex, and they have also again to thank Mr. H. A. Cole for his gratuitous artistic services in illustrating our programmes and journal with many pictures of local interest.

The parts of THE ESSEX NATURALIST published in the year comprised (with index to vol. vii.) 248 pages, with many illustrations. The Editor is fully sensible of the necessity of more regular publication, but with the numerous Club matters which engage his attention it is easier to promise reform than to compass it. No member of the Club can be more anxious for the success of the journal, and as opportunity offers every effort will be made to keep the issues more regular in dates of appearance.

TECHNICAL INSTRUCTION.—The members of the Club co-opted to the Technical Instruction Committee by the Essex County Council, on the nomina-

Dr. TREASURER'S STATEMENT OF INCOME AND EXPENDITURE FOR YEAR ENDED 31ST DECEMBER, 1894. *Cr.*

GENERAL ACCOUNT.

Dr.	£ s. d.	£ s. d.
To Subscriptions, 1891	0 10 0	
,, ,, 1892	3 10 0	
,, ,, 1893	39 10 6	
,, ,, 1894	147 3 0	
,, ,, 1895	11 8 0	
		202 11 6
,, Entrance Fees		7 17 6
,, Advertisements		3 10 10
,, Balance (excess of Payments over Receipts)		95 14 11
		£309 14 9

Cr.	£ s. d.
By Balance from 1893 (excess of Payments over Receipts)	75 10 1
,, Printing and Illustrating "Essex Naturalist"	83 13 10
,, General Printing and Stationery	15 13 11
,, Postage of "Essex Naturalist," Circulars, Officers' Correspondence, etc.	21 19 2
,, Incidental Expenses	18 8 2
,, Rent of Central Museum Premises	25 0 0
,, Cost of Cleaning and Renovating Premises	10 8 6
,, Sundry Museum Expenses	7 13 10
,, Salary of Sub-Curator	26 0 0
,, Grant in aid of Cambridge University Extension Lectures (Chelmsford)	10 0 0
,, Fire Insurance and Gas	5 1 11
,, Purchase of Books, etc.	1 13 3
,, Fees to Lecturers, etc.	3 3 0
,, Loss on Field Meetings	5 14 1
	£309 14 9

LIFE COMPOSITION ACCOUNT.

Dr.	£ s. d.
To Balance from	104 10 6

Cr.	£ s. d.
By Balance to 1895	104 10 6

SPECIAL MEMOIRS PUBLICATION ACCOUNT.

Dr.	£ s. d.
To Sales of Publications	6 9 10
,, Balance (excess of Payments over Receipts)	33 18 4
	£40 8 2

Cr.	£ s. d.
By Balance from 1893 (excess of Payments over Receipts)	40 8 2
	£40 8 2

CENTRAL MUSEUM FUND.

Dr.	£ s. d.
To Balance from 1893	106 13 3
,, Donations paid, 1894	5 5 0
	£111 18 3

Cr.	£ s. d.
By Cases and Furniture	73 8 3
,, Jars, Chemicals, Spirit, etc.	9 11 1
,, New Door	1 5 0
,, Sundries	1 19 4
,, Balance in hand	25 14 7
	£111 18 3

FOREST MUSEUM FUND.

Dr.	£ s. d.
To Donations paid, 1894	77 16 6
	77 16 6

Cr.	£ s. d.
By Preliminary Expenses	6 16 0
,, Cases and Furniture	10 14 0
,, Sundries	4 19 7
,, Balance in hand	55 6 11
	77 16 6

N.B.—*It should be noted that the Club possesses very large assets in books, specimens, cabinets, stock of publications, etc., which although valuable cannot easily be estimated in money.*

Examined with Books and Vouchers and found correct.

March 28th, 1895.

WALTER CROUCH, } *Auditors.*
JOHN D. COOPER. }

tion of the Council of the Club, are the same as last year, viz.: Sir H. E. Roscoe, M.P., F.R.S.; Prof. R. Meldola, F.R.S.; Mr. J. C. Shenstone; Mr. J. Spiller; F.I.C., &c.; Mr. F. Chancellor, J.P., F.R.I.B.A.; and Prof. Charles Stewart, M.A., F.L.S. It is unnecessary to refer to the important services rendered by these gentlemen, as the Council understands that the subject will be alluded to by the President in his Address this evening.

LIBRARY.—The main portion of the Library has been removed to Chelmsford, but those books and pamphlets more immediately treating of Epping Forest have been retained for lodgment in the Forest Museum at Chingford. A report on the library must again be deferred, but the Council is pleased to say that Mr. W. C. Waller has consented to serve as one of the Librarians with Mr. Durrant. It is anticipated that a full report on the Library may be ready for next Annual Meeting, and this will include a list of the more important donations recently received.

CENTRAL MUSEUM.—The work of reconstructing the contents of the Central Museum, has steadily progressed during the year. All the cases have now been made serviceable, although at a considerable cost of time and money. The selection of suitable specimens from the mass of incongruous material found in the old museum has also needed a large amount of time and labour, and is by no means yet completed. A cottage has been hired at a rent of £6 per annum for the temporary reception of these specimens pending selection, and a sub-committee has been appointed to make the final selections in cases of doubt. All this work will be recorded in a full report on the Museum when the arrangements are completed.

The Club collections at Buckhurst Hill, with the exception of those purely local ones, kept for exhibition in the Forest Museum, have been removed to Chelmsford. The vast amount of work in connection with the above has prevented as much progress as could be wished being made in arranging, labelling, and cataloguing, the collections in hand, but a fair beginning has been made, and the curatorial work, now that carpentry and cabinet-repairing have been cleared out of the way, will be pushed on during the summer.

The amount of the capital expenditure has been kept within the limits of the £160 subscribed, but, as mentioned in last year's report, much more money will be required, and the Council trusts that those gentlemen who promised subscriptions, and upon the faith of whose promises the work was taken in hand, will now render the much needed aid. If the county collections are to be made worthy of the Club, it is absolutely necessary to spend a considerable sum in having a series of local birds and animals preserved, skeletons and other educational preparations made, and suitable appliances for the due display of these. Only one considerable piece of expenditure is absolutely necessary in the way of fittings, and that is the series of wall-cases, to be fitted up the staircase of the museum, for the display of the valuable educational series of geological specimens now in the possession of the Club. These are estimated, with tablets, to cost £25, and the Curator begs to make a strong appeal for funds to provide these fittings, as without them his plan of arrangement of the educational collections will be incomplete. To provide a series of Essex mammals about another £25 would be required. If these two series could be arranged, the museum would become one of very considerable educational importance. The materials for arranging many of the other collections are in hand, or can be procured by means of the balance of the Capital Fund, but the above, although of great interest, are beyond our present means.

Owing to financial reasons it will be necessary to curtail the hours of attendance of the assistants at the museum to one day per week for the present.

Various interesting donations have been made to the collections since the last report. The following may be specially mentioned :

Principal Donations to the Museums since last Report.

Dr. H. Laver.—The greater portion of his collection of Lepidoptera, very many of the specimens being from Essex.

Dr. H. Laver.—A collection of Land and Fresh-water Mollusca, mainly from the Colchester district.

Dr. H. Laver.—A collection of the Bats of Essex, mostly from Colchester district.

Dr. M. C. Cooke.—A series of about 450 plates of the Hymenomycetal Fungi of Epping Forest, extracted from his "Illustrations of British Fungi." (*Forest Museum.*)

Mr. J. T. Powell.—An almost complete set of the species of Rubi or Brambles hitherto known as occurring on the Forest, in illustration of his papers in THE ESSEX NATURALIST. (*Forest Museum.*)

Mr. G. E. Vaughan.—A large number of British Birds' Eggs, to form a type collection. (*Forest Museum.*)

Mr. A. Leaf.—A microscopical stand and collecting case, for use at the Field Meetings of the Club.

Mr. E. G. Ingold.—A small collection of the Mollusca of the Bishop's Stortford district, in illustration of his paper in THE ESSEX NATURALIST.

Mr. G. Brown.—Tusk and jaw of a mammoth and part of jaw of rhinoceros, found in his brick-pit at Chelmsford.

Several other donations of single specimens and small collections have been received. These will be acknowledged in the first report of the Curator which will be published as soon as the various collections now in hand are arranged.

THE EPPING FOREST BRANCH MUSEUM.—The rapid advance of this project has undoubtedly been the most important Club event of the past year. The local. committee, consisting of the Rev. A. F. Russell, Rev. W. T. Dyne, Rev. W. L Wilson, Mr. T. Hay Wilson, Mr. G. E. Vaughan, Mr. R. J. Sheldon, Mr. B. G. Cole, Mr. W. Cole, Mr. H. A. Cole, Mr. W. C. Waller, and Mr. E. Johnston, have worked energetically to obtain the necessary funds, and arrange the various details with respect to the establishment of the museum. Donations equal to £109 (including a donation of £20 from the Drapers' Company) have been promised, and the major part paid, as well as annual subscriptions of about £8 per annum. The Agreement with the Epping Forest Committee of the Corporation of London was signed on the 31st of December, and the work has since been steadily advanced. As this, however, will properly belong to 1895, and as a full report of the origin and progress of the museum will be presented by the local committee at the opening ceremony, it is thought best to defer any remarks upon the subject. But the Club is to be congratulated on the success which has attended this movement, which cannot fail to increase the interest taken in the study of natural history and antiquities in the forest districts.

PARTITION OF THE COUNTY.—It was with great regret that the members and the Council heard last year that an attempt would be made to transfer ten Essex Parishes to the County of Hertfordshire, and Bartlow Hamlet to Cambridgeshire, and at the meeting held at Dudbroke Park, on July 28th, a resolution was passed protesting in the strongest manner against any such interference with the old boundary lines of the County. This resolution was sent to the County Council and the members of Parliament, etc. The Council is happy to say that the almost universal protestations which the project called forth led to its abandonment, and the county was saved from a most unnecessary and unpatriotic curtailment.

Mr. Chancellor, being of opinion that the President should not retain office, unless under very special circumstances, for more than two years in succession, has placed his resignation in the hands of the Council. The Council has nominated Mr. David Howard, J.P., F.C.S., F.I.C., an original member of the Club, and a gentleman well known in scientific circles, as well as a resident in the county, and one taking a great interest in its welfare and progress, to the office.

It is only due to Mr. Chancellor that the Council should express the high sense of the value of his services as Chairman of our meetings, entertained by the members. Mr. Chancellor's services, as one of the Club's nominees upon the Technical Instruction Committee, have also greatly advanced the cause of scientific instruction in our county. Under the rules, Mr. Chancellor, on retiring from the presidency, becomes one of the permanent Vice-Presidents of the Club, and the Council is glad to thus retain the benefit of his advice and assistance.

THE PRESIDENTIAL ADDRESS.

DELIVERED AT THE FIFTEENTH ANNUAL MEETING, ON MARCH 30TH, 1895.

By FREDERIC CHANCELLOR, J.P., F.R.I.B.A., *President.*

LADIES AND GENTLEMEN,—I have been somewhat exercised in my own mind whether or not I should give another address at the termination of my second year of office, but as it seems desirable to preserve the continuity of these annual addresses, I have elected to do so. What the subject should be, I found to be a far more difficult point to be determined.

In my 1894 address I gave you a history of the development of Architecture in Essex, but I feel it would be a refinement of cruelty to repeat the subject this year; *toujours perdrix*, however well served up, is apt to pall upon the palate. Now, I find there was a custom started by our first President, and followed several times since, of reviewing the work done by the Club during the previous year or years, and I do not think I can improve upon that custom. I therefore propose to give you a *résumé* of the proceedings of the Club, and the various works they have been connected with during the past two or three years.

It will be in the recollection of members that the meeting at which I took the chair as your President for the first time, on April 15th, 1893, was the first meeting of the amalgamated societies—the Essex and Chelmsford Museum and the Essex Field Club—and it will be interesting to recount, and put upon record, what has been done since then in remodelling our Museum and Library. After the amalgamation of the two Societies took place, the remodelling of the Museum was the first matter that had to be taken in hand. As, of course, no one could give a very continuous amount of time to this work, it has proceeded but slowly, but I think I may now say that as far as regards the cases the remodelling has been, in great measure, completed, and considerable progress has been made in the re-arrangement of the specimens. As for instance, the collection of Birds has not only been very much added to, but has been so arranged as to be of practical use to the student. The Herbarium has also been arranged, and is now available for use. The very valuable collection of Crag Fossils, presented by our member, Mr. G. P. Hope, is also available for use, and the collection of Flint Implements and allied relics is also in course of arrangement. The Tusk and Jaw of the Mammoth, and the Jaw of Rhinoceros dug up at Chelmsford are amongst the most interesting and recent additions. As regards the Library, progress has been made in arranging the books, and in the preparation of a catalogue. The members will be glad to know also that not only will the Museum be of interest to visitors, but that it has already been made use of for students, as Mr. Houston, (Staff-teacher of Biology to the Technical Instruction Committee), has held two classes there, for the convenience of illustration by specimens in the Museum, and it is to be hoped that in the future increased use will be made of it for like purposes.

The most important matter, however, which has been carried out during the last two or three years in this county is the question of Technical Education. It will probably be in the recollection of most of our members that in 1890 when the Essex County Council advertised for applications for grants for technical education, the Council and members of this Club, after careful consideration and discussion, came to the conclusion that the most effective way of dealing with the large sum of money, £17,000, placed under the control of the Essex County Council, would be by forming a central educational establishment, consisting of a museum, laboratories, and class-rooms, furnished with all the necessary apparatus, and the Club, therefore, through their hon. secretary, Mr. W. Cole, formulated a scheme, and applied for a grant. The scheme included—(1) The establishment of a central institution in Chelmsford, in connection with the Club's Museum, with large laboratories and class rooms, furnished with apparatus and preparations for practical teaching, and in which, as occasion might arise, examinations could be conducted; the institution being also amply provided with lecturing and class-teaching appliances (lanterns, slides, diagrams, apparatus, models, materials, and specimens), so arranged in travelling cases that they could be easily sent to any part of the county for use at local lectures and classes. (2) The arrangement of peripatetic courses of classes and lectures, conducted by specially qualified teachers (either supplemental to local efforts, or at the sole instance and cost of the institution) for imparting instruction in science and technology in any parts of the county, particularly in rural and maritime districts. The teaching given to be either elementary or more advanced, but always as far as possible of a thoroughly practical character, and such as will give a knowledge of things rather than words, and develop the faculties of seeing and doing. A list of the most important of the subjects to be taught were grouped together under thirteen heads. It was pointed out that this scheme would permit of the best kind of instruction being given, not only in towns, but also in rural and maritime districts, and that at a minimum cost. It was also pointed out that the scheme would permit of any future development without any interference with the work thus being carried on. After indicating the advantages of this scheme, a financial statement was appended, by which it was shown that the cost of Site, Buildings, and Fittings would be £3,500, and the miscellaneous expense and annual maintenance £900. With our proverbial modesty we asked the County Council for the following sums: Contribution towards the building, £500; apparatus and materials, travelling expenses of teachers and apparatus, £1,000; maintenance of laboratory, etc. per annum £200; administration charges, ditto, £150; Teachers' fees, etc., ditto, £500; together, £1,500 as a capital sum and £850 per annum. Of course the invitation from the County Council produced many other applications, and it can readily be understood that the Council would have some difficulty in dealing with the numerous applications thus received in reply to their somewhat light-hearted invitation. The scheme of the Essex Field Club was urged upon the consideration of the County Council by a very influential deputation, consisting of Sir Henry Roscoe, Professors W. H. Flower, Meldola, and Boulger, Mr. F. W. Rudler, and our Hon. Sec., Mr. W. Cole, who met Mr. E. N. Buxton and other members of the Parliamentary Committee on Feb. 2nd, 1891.

The outcome of the Club's application was that at a meeting of the County Council on July 7th, 1891, the report of the Technical Instruction Committee was adopted, which included the following recommendations: (i.) A sum not exceeding £250 be granted to an organising Joint Committee, consisting of six members of the Committee and six members of the Essex Field Club for administration purposes, and the constitution of a centre for the supply of Lectures and Teachers, whose services will be paid for by the Urban Authorities or Local Committees engaging them. (ii.) That a sum not exceeding £500 be granted to the same Joint Committee for purchase of apparatus and diagrams, and a sum of £100 for storage and carriage of same. (iii.) That a sum not exceeding £50 be granted to the same Joint Committee for lectures under the direction of the Essex Beekeepers' Association. (iv.) That Local Committees throughout the county, especially in rural districts, be recommended to make application to the said Joint Committee of the Essex Agricultural Society, for aid in lectures or teachers, obtaining apparatus and materials, the conducting of examinations, and seeking help and guidance generally. The following were the members elected to form the organising Joint Committee by the County Council: Messrs. E. N. Buxton, E. A. Fitch, T. H. Burrows, S. W. Squier, F. West, and W. B. Whittingham. By the Club, Professors Boulger and Meldola, Sir Henry Roscoe, Messrs. F. Chancellor, F. Rudler, and J. C. Shenstone, and at the first meeting on July 20th, 1891, Mr. W. Cole was appointed Secretary. But the Council, at their meeting on July 7th, 1891, also adopted the other recommendation of the Technical Instruction Committee, that the larger portion of the funds at their disposal should be divided among local authorities on the basis of 1d. in the £ of the assessment to the county rate of the district concerned. This in some respect was an unfortunate decision, because in many cases the sums were too small to do any real good, and consequently the money was frittered away in feeble efforts to do something.

The Organising Joint Committee very soon set to work, and commenced by hiring a house, No. 44, Duke Street, Chelmsford, as a store for the apparatus, and they appointed a caretaker, who, being a man of mechanical ability, could make himself of value by repairing, packing, and generally taking charge of the property of the Committee. They also engaged the services of Mr. Houston as a Staff Instructor in Biology. Considerable progress was made, so that by March, 1892, your then President, Mr. Fitch, was able to report to your Annual Meeting that classes and lectures had been held at forty-seven centres, and apparatus of the value of £400 had been purchased. About this time a change was made by abolishing the Organising Joint Committee, and adding six members of the Club to the Technical Instruction Committee, viz., Sir Henry Roscoe, Professor Meldola, and Messrs. F. Chancellor, J. C. Shenstone, J. Spiller, and G. J. Symons. This Committee appointed a Scientific Sub-Committee, consisting of the six members of the Club and six other members of the Technical Instruction Committee. And it may be said that this Sub-Committee has materially assisted the main Committee by threshing out the details of matters submitted to them, and by getting into shape the various schemes which from time to time required to be carried out in order to push on the important subject of Technical Education on the proper lines.

It was not very long before it was found that the premises in Duke Street were not only too small for storage purposes, but that it was quite impossible to form classes of any reasonable size at the Central Station for want of the necessary accommodation. At this time the premises formerly occupied by King Edward's Grammar School were in the market, and the Scientific Sub-Committee strongly urged the purchase of these premises, and the Technical Instruction Committee supporting the scheme, the County Council eventually gave consent to the purchase. About this time the necessity of appointing a Staff Instructor of Chemistry was urged by the Sub-Committee, and was eventually agreed to, and Mr. Dymond was appointed. As soon as possession was obtained of the school buildings the County Surveyor was instructed to put them into good repair, and to make such structural alterations as were suggested by the Committee. The two Lecture Rooms, Preparation Room, and Stores were then fitted up under the direction of the Sub-Committee, with all necessary lecture-tables, working-benches, cases, and other matters, and on February 20th, 1894, the new premises were opened by Mr. Andrew Johnston, who gave a short address, and the whole of the rooms in which objects of Physical, Chemical, and Biological interest had been arranged, were open for public inspection. Regular classes are held under the direction of the Staff Instructors, aided by their Assistants, whom it was soon found necessary to appoint in order to keep pace with the work at the Central Station and with the numerous appeals from other parts of the county.

It must be admitted that a very important work has been carried out during the last three years, and must even satisfy those who originally opposed the idea. That much better work would have been done with the large sum at the disposal of the County Council if some half-a-dozen or more similar stations had been established throughout the county, instead of dividing the money into very small sums, which is now necessary in many cases, must, I think, be apparent to most of us who have had to carry out the work of the Committee.

The two great industries of this county are Agriculture and Fishing, including Oyster Culture, and the Technical Instruction Committee have directed their attention to the problem how best to assist these two industries, in common with other important industries. Many of the Chemical Lectures and Experiments, under the direction of Mr. Dymond, and many of the investigations as to Plants and Insects, under the direction of Mr. Houston, have had a direct bearing upon the growth and diseases of corn and roots, and upon the increased fertility to be obtained from manures, and I hope before we are very much older to see a small Experimental Farm attached to the Chelmsford Station, and proper Museum accommodation, and even a County Agricultural College.

I cannot help feeling that the members of the Scientific Sub-Committee are looked upon as to some extent visionary enthusiasts, and extravagant in their requisitions, but I can say without fear of contradiction that they have never recommended the expenditure of one shilling until they had satisfied themselves of its absolute necessity. The very reason for our continued requisitions is, because the whole scheme has been a success; if it had remained stationary, the money spent upon it might have been said to have been lost, but when you have a healthy plant, do you starve it and leave it alone? On the contrary, you dig about and manure it, and encourage its growth. So it is with this great scheme of Technical Education; we have excited interest and attention to matters which are of the highest importance as affecting our County Industries, and the more people you can get to come and inquire and learn the more assistance and the more plant you want, and it would be the very worst policy to check this inquiring spirit. Then, as regards Fish Culture, it was felt that, with nearly 100 miles of sea-board, to say nothing of our rivers, this was an industry that should be looked after and assisted, and so we some time ago directed our attention to the establishment of a Marine Biological Station, and this is now an accomplished fact, as we have at Brightlingsea a station, very modest and unpretentious, but fitted up with a view of carrying out experiments in Oyster Culture, and in the growth, development, and diseases of other Fish. We are endeavouring, by forming a Museum, giving lectures, carrying out experiments, and by other means to interest the fishermen of the county, so that every fact in connection with the successful growth of Fish may be brought under their notice, with a view of preventing waste and improving the yield of their industry.

I have gone into the above question somewhat in detail, because, as the Essex Field Club were the pioneers in formulating a scheme for Technical Education for the County, it is only right that the result of their efforts should be duly chronicled. The County of Essex owes a great debt of gratitude to Professor Meldola and the other members selected by the Club, who are not connected with Essex. Of course, as regards those members who are Essex men no thanks are due to us, because it was our duty to obey the call made to us; but as to the other gentlemen to whom I have alluded, they had no county ties, but were actuated by a desire to use their knowledge and their influence in carrying out the works allotted to them to a successful issue. Professor Meldola has devoted a great amount of his valuable time to the matter, and has brought his technical knowledge to bear upon the discussions which have occurred at critical periods.

Another change in the working of the Technical Instruction Committee has just been made—the Scientific Sub-Committee has been done away with, and therefore in the future all matters for consideration will not have the advantage of being critically examined before being brought before the General Committee. Whether this new arrangement will be an improvement time will prove. I have my doubts, as I believe the preliminary threshing out that everything received when before the Sub-Committee brought out all the weak and the strong points of any proposal.

During the last two years several Meetings of the Club have been held, many of them of great interest.

On the 29th April, 1893, a Field Meeting was held at Uphall Camp, and extended over the famous Elephant Hunting Grounds of our friend Mr. Henry Walker.

On the 13th May, 1893, another Field Meeting was held at Chingford, Bury Wood, and Sewardstone.

On the 17th June, 1893, we had another very pleasant Field Day to Bicknacre, Danbury, and Malden, when the Churches of Great Baddow, Danbury, and Woodham Walter were examined, and the fragment that remains of Bricknacre Priory. At Danbury the Camp was examined and made more intelligible by Mr. F. C. J. Spurrell's Plan. The Naturalists and Botanists of the party were interested in their ramble over Lingwood Common, through Holly and Long Woods, in the latter especially, by the pair of young night jars, which had been carefully watched over by our member, Mr. Smoothy. The inspection of the remains of Woodham Walter Hall, the once baronial residence of the Fitzwalters, completed a very interesting excursion.

An Ordinary Field Meeting was held on the 1st July, 1893, at Barkingside and Wanstead, which was more particularly interesting to the Geologists.

One of the most interesting meetings of the year, was held on July 29th, 1893, when all Sections of the Club were in turn interested, as the day's Water Excursion on the River Stour, through the Vale of Dedham, was developed. The wealth of the botanical display along the banks of the river, so ably explained and identified by Mr. Chas. Wright, became interesting even to others who had not taken up Botany, as a subject of study. The artists of the company were reminded that we were travelling through John Constable's Country, of whom Mr. C. Benham gave a very interesting account. At Dedham the Archæologists were charmed with the fine old Church and its grand old tower, and the Monuments to the Webbes the merchant princes connected with the Bay and Say Trade, and the remains of the old Mill, used in the manufacture of those articles.

A very agreeable Meeting was held on August 2nd, 1893, when the Club was met at Castle Hedingham by "The sette of Chelmsford Odde Volumes." Castle Hedingham is always interesting. The grand old Castle, outliving the Grand Old Family to whom it owes its origin, is still an object of engrossing interest to the Architect and Archæologist.

On August 11th and 12th, 1893, another Meeting was held at, or I might say in, those absorbing remains, The Deneholes. Through the exertions of the Club, many of these have now been connected, so that under the able guidance of the gentlemen who conducted the explorations (Mr. T. V. Holmes and Mr. W. Cole), assisted by Mr. Crouch, we travelled through the whole series without having to come to the surface.

On August 19th, 1893, the Club, upon the kind invitation of Mr. and Mrs. Lescher, visited Boyles Court, near Brentwood, and inspected the fine Museum of Stuffed Birds, collected by the late Mr. J. D. Hoy.

At the meeting held on the 4th November, 1893, Mr. Cole, the Hon. Sec. announced that Mr. G. P. Hope, of Upminster, had presented to the Museum of the Club his fine Herbarium of Marine Algæ from the Harwich District, as well as some fossils from Walton-on-the-Naze, and bronze celts from Havering.

At the Annual Meeting on the 31st March, 1894, the usual business was transacted, and the President read his address on "The Development of Architecture in Essex" and the establishment of the proposed Epping Forest Free Local Museum, which had been considered at a Meeting held on 24th February, was alluded to.

But perhaps one of the most important Meetings of the Club was the one held in Epping Forest on the 28th April, 1894. In consequence of the action of the Verderers in thinning in various parts of the Forest some very strong letters had appeared in the daily London papers, condemning the action of the Verderers, and in point of fact, holding them up to the public as malefactors of the deepest dye. On the other hand, letters appeared upholding the action of the Verderers as judicious and well-timed.

Under these circumstances it was considered desirable that a Meeting of the Club should be held upon the debatable ground itself, so that the numerous experts who were members of the Club might have an opportunity of examining what had been done for themselves. Mr. E. N. Buxton, who seems to be at home in the most intricate parts of the Forest, was the chief "Conductor," and he certainly made no attempt to conceal anything that had been done. A meeting was afterwards held at the Forest Hotel, Chingford, which has been carefully reported in THE ESSEX NATURALIST for 1894 (vol. iii., pp. 52-71, and pp. 117 121), and which I need not further allude to, except to say that in the opinion of the Club the action of the Conservators was supported by the passing of the following Resolution by a large majority: "That in the opinion of this Meeting, the general action of the Conservators in the recent thinnings has been judicious."

It is satisfactory to find that this verdict has been endorsed by the experts called in by the Corporation of the City of London.

One of the most interesting meetings we have held, was the meeting of the Club at the Museum and Library of the Corporation of London, at Guildhall, in the City, on the 16th February, 1895, upon the kind invitation of J. Douglass Mathews, Esq., the Chairman of the Library and Museum Committee, and Charles Welch, Esq., the Librarian and Curator, when the latter gentleman read a very carefully prepared paper upon the principal objects of interest in the Museum and Library, and subsequently accompanied the members round the Museum, pointing out the various objects he had alluded to. The Chairman, Mr. Mathews, at the commencement of the proceedings, when there were about one hundred ladies and gentlemen present, the majority of whom were members of the Club, expressed his astonishment at having so large a meeting. I took the opportunity of reminding him that if the meeting had been held previous to the establishment of the Essex Field Club, he would have had only one tithe present, and that I thought by the exertions of the Club, a very large number of persons had become interested in the study of the various subjects to which attention had been drawn that day, and were anxious to increase their knowledge.

I think meetings of this kind are very desirable, because attention is periodically called to all kinds of interesting relics, and so they become familiar to our members and enable them at once to grasp the importance of investigating local excavations of any kind and the removal of old buildings, or the turning out even of old lumber rooms, and thus many an object of deep interest will be preserved, which would otherwise have been consigned to the dust-bin.

Another important work which has engaged our attention during the last three years has reference to the Bibliography of the County of Essex. It was felt by some of the members of this Club, especially by those who were desirous of referring from time to time to books relating to various matters connected with the county, that there was no record, public or otherwise, of works written by Essex men and women, or upon subjects connected with Essex. At a preliminary meeting of a few gentlemen interested in the matter, a committee was formed, consisting of Lord Rayleigh as President, Mr. F. Chancellor as Treasurer, with Messrs. E. A. Fitch and R. Miller Christy as Honorary Secretaries, together with Messrs. G. Alan Lowndes, I. Chalkley Gould, Thos. Bird, W. Cole, and E. Durrant. "The object of the Committee," quoting from the original circular, "shall be to compile and to arrange for the publication of a complete and comprehensive work on the Bibliography of Essex, which shall enumerate all books, pamphlets, magazine articles, maps, prints, and other publications that wholly or largely treat of the Topography or History of the County of Essex; or that have been written by, or about, prominent natives or residents in the county, together with all works that have been published within its borders." It was at first supposed that the subscriptions of thirty members at two guineas each would be sufficient for the purpose. Mr. W. H. Dalton, F.G.S., a competent and experienced bibliographer, was engaged to visit the various public and private Libraries for the purpose of obtaining the necessary information, and it was hoped that he would be able to complete his task within a year, but it was very soon apparent that we had under-estimated the amount of literature connected with the County, and the time had to be prolonged and further subscriptions obtained, the result being that we have collected and expended nearly £150, and that we are now in possession of about 10,000 slips, containing all the usual information required for such a work. It was agreed in the first instance that when completed the manuscripts should be offered to the Essex Field Club for publication. This has been done, but the Committee of the Club, feeling that it was too serious a matter to undertake alone, invited the Essex Archæological Society to join them. This has been agreed to, and the MSS. are now being edited, but I fear very slowly, as it requires continuous application, which we cannot expect any of our members to give; before therefore the matter is in the hands of the printers we shall have to put the matter in the hands of some competent man to get it into shape, and it ought not to be very difficult to get the necessary funds for this purpose.

And this brings me to a matter which has been talked about for some little time since, but has never, I believe, been publicly suggested. I allude to the amalgamation of the Essex Archæological Society with the Essex Field Club. It would be extremely difficult to say where the functions of the Archæological Society end and where those of the Essex Field Club begin. In one of the Field Days of the Club fixed for the purpose of examining the Flora and the Geology and the Natural History of a particular district, would it be possible to prevent discussion upon an ancient camp, which might be come across in the course of the ramble, or would the members be prohibited from walking round and into an interesting Mediæval Church or building which appeared before them? And yet it might be said if they did so they were poaching upon the manor of the Archæological Society. No doubt there is a good deal to be said on both sides of the question, but I am not sure whether by joining our forces and so saving one set of establishment expenses we might not be able to do more with the same amount of money than is now done by the Societies acting separately. If it is considered desirable there ought not to be any great difficulty in carrying out the amalgamation.

Another matter which I think I may fairly allude to upon this occasion, because I think some members of this Club are the chief conspirators, is the establishment of "The Essex Review." To quote from the Editorial Preface in the first number: "The object of 'The Essex Review' is to gather up into one publication all matters of permanent interest relating to the prosperity of history and literature of our County. Its aim is to be an instructive, interesting, accurate, and convenient record of facts collected into a concise but comprehensive form, from the multitude of sources of information which now exist. Many of these facts might otherwise wander down the stream of time, and perish in oblivion. We seek to conserve all materials for County History, the value of which is so well appreciated, but which are so difficult to obtain, even by diligent students in their special subjects. The want of such a County record must have been often felt, and it has not hitherto been satisfied, though the many local newspapers and the various journals or magazines of a cosmopolitan or special nature contain much about the statistics, history, arts, agriculture, commerce, manufactures, literature, and even topography and biography of the county." The first number was published in January, 1892, so that we have now entered the fourth year. No payment is made for any of the articles, and the work is brought out in as economical manner as possible, consistent with efficiency, but we require better support, and if it is to be continued there must be at least 100 additional annual subscribers in order to make both ends meet. At present there are between 500 and 600, and it ought not to be difficult to get 100 additional names out of the whole county in support of a distinctly county periodical.

I have now, I believe, touched I fear but very imperfectly, upon the work of the Club and of its members during the last two or three years. I have told you how the amalgamation with the Chelmsford Museum has been completed, and how the remodelling of the Museum and joint-Libraries of the two Societies is progressing. I have told you of the important work carried out in reference to Technical Education, especially of the establishment of a Central Institution, in accordance with the original suggestion of the Club. I have recalled to your minds the principal events in connection with our summer rambles, and I have drawn your attention to the important work carried out by the Bibliographical Society, and I hope I have sufficiently impressed upon your minds the important step taken in the starting of "The Essex Review," and the great necessity of giving that publication your hearty support. And, in conclusion, I hope I may not be considered to be beating the Essex Field Club drum too noisily when I venture to say that I think we may fairly congratulate ourselves upon having done something towards the advancement of Art and Science and Literature. I feel that at no time of its existence has it occupied a better position than it does at the present moment, and I feel confident that its usefulness in the future will increase. I believe the outside world believes that we are honest in our endeavours to make the study of all the 'ologies an agreeable and pleasant recreation, and that our chief aim is to advance the study of matters connected with our industries, so that we may be able to compete with foreign countries upon something like even terms. In quitting the Presidential chair, I have to thank the members and the officers of the Club for their loyal and courteous support of me upon all occasions. I have endeavoured to perform the duties of the office to the best of my ability, but I cannot but feel that I can in no way compete with those who have preceded me in the chair. But I think I may congratulate myself, in handing over the chair to my successor, that I hand it over as a well-nurtured and flourishing tree in full and robust health.

[As one or two of the important subjects touched upon in Mr. Chancellor's able and interesting address are of a somewhat controversial nature, while one other at least may, in the future, come before the Club for consideration, the Editor may be permitted to say that the Council and members of the Club are in no sense bound by the opinions which Mr. Chancellor, as President of the Club, and as an active member of the Essex Technical Instruction Committee, is so fully competent to make. Also, we may point out, to prevent further spread of misunderstandings, which have already arisen, that "The Essex Review" is wholly a business speculation of some members, and that the Club has no official connection with it in any sense. And, perhaps, it may be as well to state, further, that the Library and Museums of the Club are its sole property, and that no money for fittings, etc., has been received in any way other than by contributions of old members of the Club, previous to the amalgamation of the Chelmsford Museum. The public appeal for funds has, up to the present time, met with no response.—ED.]

THE PROTECTION OF WILD BIRDS IN ESSEX.

AT the commencement of the year the attention of the Council of the Club was directed to the above-named important subject by our member, Mr. Miller Christy, F.L.S., who, as the author of the admirable book "The Birds of Essex," is so qualified to advise on this matter. Mr. Christy pointed out the important powers conferred on the Secretary of State under the act to amend the Wild Birds Protection Act, 1880, passed in July, 1894 (57th and 58th Vic., cap. 24), which powers might be exercised at the request of the local authorities of the counties, and he suggested that the Club should take some action to induce the Essex County Council to adopt the Act so far as the Essex shore-breeding birds were concerned. In common with many other writers on the subject, Mr. Christy pointed out that any attempt to stop bird-nesting entirely was not only of very doubtful expediency, but it would probably fail, as public opinion would be against any such drastic and unfair measures. There are few birds whose eggs really stand in need of protection, with the exception of the above-named shore-breeding species and the *Owls*. Mr. Christy is of opinion that all small warblers and finches were never more numerous in England than to-day, and there are many more species which have increased quite as much as others have decreased. With most of our Essex shore-breeding species, however, the case is very different. Many have already been locally exterminated, and probably all will disappear as breeders on the coast if protection is withheld for another ten years. They are all ground-builders, and as they breed largely in colonies their destruction is peculiarly easy. It is noticeable that when a colony has been once exterminated the spot is very often never again occupied, even though it may itself remain quite unaltered. It would be very desirable to bring under the protection of the new Act all the Terns, the Gulls, the Ducks, the Ringed Plover, and the Oyster-catcher. These species (especially the Terns) are highly ornamental and interesting, and as they are also absolutely harmless they are in the highest degree worthy of protection. In the "Birds of Essex" may be found many arguments in favour of affording protection to these species. The Sandwich, Arctic, and Common Terns are all extinct as breeders in Essex, but they might return in future years if unmolested. The Lesser Tern (an extremely ornamental bird) is certain to be lost to us within a few years if not protected (see "Birds of Essex," pp. 259, 260). The following extract from a letter from Mr. Harold Raeburn to Mr. Christy will show how these birds become extinct:

> "On a patch of sand and shingle, about four miles south of Harwich, I found a few Lesser Terns nesting [these are the remnant of the strong colony mentioned at the bottom of p. 259 of the "Birds of Essex."] I counted them carefully, and I think that there were seven or eight pairs. I soon found six nests, containing respectively 3, 3, 3, 2, 1, and 1 eggs. I selected one of the threes and also one of the ones, which were very peculiarly marked. Just as I was leaving a party of four men with guns (in the close time!) came over the sea-wall and made for the shingle, off which they cleared every one of the eggs I had left. . . . . If this sort of thing is allowed to continue the Lesser Tern will soon be extinct as a breeding species in Essex. The place is so small that every egg may be easily

found in half an hour or so, and the birds themselves are very unwary in the nesting season."

In view of considerations such as the above the Council of the Essex Field Club addressed the following petition to the Essex County Council:

TO THE COUNTY COUNCIL OF ESSEX.

THE PROTECTION OF WILD BIRDS.

THE PETITION OF THE ESSEX FIELD CLUB.

Under an Act of Parliament (57 and 58 Vic., c. 24) which received the Royal assent on 20th July, 1894, entitled "An Act to amend the Wild Birds Protection Act, 1880," it is now in the power of the County Council to apply for an order of the Home Secretary to take one or other of the two courses proposed, namely, an order prohibiting—

(1.) The taking of eggs of any named species; or

(2.) The taking any eggs within a certain specified area.

The Essex Field Club beg to request the County Council of Essex to apply to the Secretary of State to order that the Act shall be set in force in respect to Section 2 (1) of the Act, which reads as follows:

> "The taking or destroying of wild birds' eggs in any year or years in any place or places within that County."

And, in this case, the Field Club respectfully suggests that application be made for protecting the following specified and well-defined area along the coast of Essex within the jurisdiction of the said Council—see Section 2 (3),

> The sea coast, sand hills, dunes, waste lands, foreshore, warrens, marshes, saltings, situate between the sea and the land side of the sea wall, embankment, ditch, quick fence, or any other artificial boundary separating the same from the cultivated land.

There are several species of birds, as the Sheldrake, Sea-pie or Oyster-catcher, Ringed-dotterel, Sandwich, Arctic, Common, and Lesser Terns, Redshank, which formerly frequented the coast of Essex in the nesting season in some numbers, but at the present time are verging on extinction, and in some cases it is doubtful if this point has not already been reached.

The cause of this falling away of their number and threatened extinction as nesting species is the persistent disturbance and plunder of their nests in the breeding season by excursionists to the coasts, and largely by men and boys who now make a regular trade of taking the eggs to sell to visitors at the watering places, bird stuffers, and egg collectors. In recent years this mischief has become greatly intensified.

The protection of the area thus specified would not interfere with any private or vested interests, as the land is wild and uncultivated; nor would it in the slightest degree encourage the undue increase of any species which are supposed to be inimical to the cultivation of the soil, all the species named above being coast feeders; and the few small birds not named and nesting in the same area —as the Wheatear, Stonechat, Whinchat, and Meadow Pipit, along with a few Summer Warblers—being exclusively insect feeders.

The 1st of April to the 1st of July would cover the period during which the eggs are deposited and incubated.

The Essex Field Club respectfully trust that the Council will make the necessary application to the Secretary of State, asking that the specified area, as determined upon, may be named as a protected area during the nesting season.

In the opinion of the Council of the Club the granting and enforcement of such powers as are permitted under the Act would undoubtedly result in the protection and increase of the species of shore birds nesting within the area; and, in these days when Natural History is becoming the delight and recreation of the many, it would also greatly tend to enhance the interest and pleasure of a visit to the sea coast. Signed on behalf of the Council of the Club,

WM. COLE, *Hon Secretary.*

This Petition was referred by the County Council to a committee appointed to consider the provisions of the Wild Birds' Protection Act, 1894, of which Mr. Champion B. Russell, J.P. (son of the late well-known authority on all matters relating to coast birds of the county, the late Colonel Russell) is chairman, and after due consideration the main provisions asked for were recommended for adoption by the committee, and were sanctioned at the meeting of the County Council on April 2nd last. Mr. Champion Russell has written to us (under date July 9th, 1895) giving some interesting details of the considerations which induced the committee to accept the proposals, and also of the reception of the recommendations by the Secretary of State, and he has kindly allowed us to quote from his letter as follows:

"To begin, the Act of 1894 being permissive, the question came before the County Council whether to adopt it or not. On the one hand, to do so might seem like making a law which was in advance of public opinion, and which could not be worked, especially in view of the bird-nesting traditions of English boyhood, the difficulty of discriminating between the eggs of different birds, and the systems of our educational authorities, which result in ignorance though crammed with learning. On the other hand, the gradual extinction of many rare and beautiful birds makes it almost criminal to omit any means of protecting them, and the mere fact of their protection gives a public lesson in Natural History.

"The recommendation of the Essex Field Club showed an excellent step which appeared to be beyond cavil; as shore-nesting being a less break-neck business than tree-climbing has less attractions for boys, while the shore can be easily watched; indeed, we have an excellent force in the coastguards, who might well undertake to prevent illicit bird-nesting on the coast.

"Thus it came that the County Council made application to the Secretary of State, under Section 2 (3) of the Act, to declare the following protected nesting area, viz.:—'The sea-coast, sand-hills, dunes, waste lands, foreshore, warrens, marshes, saltings, situate between the sea and the land side of the sea-wall, embankment, ditch, quick-fence, or other artificial boundary separating such lands from the cultivated land; the order to be in force for three years from the 15th day of March to the 1st day of August in each year, and that the following reasons be given for the application in accordance with the section, viz.:—That no harmful birds breed in the areas specified, which are, on the other hand, the sole breeding places within the county of many useful and interesting birds, which are in danger of becoming extinct.'

"A further application was made under Section 3 of the Act, that the provisions of the Act of 1880 might 'apply to the following birds not included in the Schedule to that Act, viz.: Martins, Sand-martins, Swallows, and Swifts.'

"To these applications a reply (dated 25th April, 1895) was received from the Home Secretary objecting that the order asked for was of a 'very wide and sweeping character. The coast-line of Essex, with its numerous estuaries, is very extensive, and Mr. Asquith would suggest whether it is not possible to specify particular areas or places to which rare birds, in danger of extinction or serious diminution, resort for breeding purposes, instead of prohibiting the taking of eggs over so large an area. The Secretary of State would require more information as to the kinds of birds which are in danger of extinction or serious diminution before he would be justified in making an order. Where large areas are sought to be protected it is important to enumerate the principal kinds of birds which breed in them in order to enable the Secretary of State to judge of the probable effect of the proposed order.' In conclusion, Mr. Asquith intimated that he did not think sufficient reason had been shown for the proposed addition to the Schedule of the Act of 1880.

"About the same time an intimation reached the Wild Birds' Protection Committee that the County Council of East Suffolk had made a similar application to that from Essex, and that the authorities were prepared to meet a deputation from the two counties.

"It may be worth while adding that to meet the views of the Secretary of State there would be no objection to reducing the area proposed to that portion of coast, etc., between Thames Haven and Harwich Light-house, and such portions of the shores of the Crouch, Blackwater, and Colne Rivers as are between Battle Bridge, Maldon, and Wyvenhoe. But it is absolutely necessary to protect the *whole area*, as it is impossible to foretell what spots rare birds may first select as breeding places; and if a *small area only* were proclaimed, such as the known nesting haunts of gulls or terns, the fact of their presence would be at once advertised, and to the egg-collector the prohibition might be as suggestive as the 'Don't nail his ears to the pump' of the old story. As almost half the Norfolk coast has been sanctioned as a nesting area, it is probable that a similar boon may be conferred on Essex.

"With regard to the inclusion of the swallow tribe the 'reasons' which were asked for in the Secretary of State's letter (but which are only required under the Act in the case of applications for the protection of eggs) are these: That the birds are absolutely harmless, and most useful, beautiful and attractive; that owing to the peculiar flight of the whole swallow tribe there is no danger of their being mistaken for other birds; that they require protection especially, as it is the habit of some would-be 'sportsmen' to shoot at them as they skim over streams and ponds with splendid swiftness—a crime no less wicked than that of the Italian miscreant who goes 'fly-fishing' for them from some tall bridge with a feather on his hook!

"It is probable that before another nesting season application may be made for the general protection all over the county of the eggs of such rare, useful and easily distinguished birds as owls, reed pheasant [the bearded-tit, *Panurus biarmicus*], and the golden oriole. At any rate, such applications have been granted in other counties. But except in the case of birds which are rare or diminishing in numbers, it would be superfluous to give additional protection.

"In the Metropolitan District, however, there is no doubt that special protection is required, and you will find the result of the deliberations of the four counties in the last County Council Report (*see below*). I fear that a good many of the birds mentioned may never come to find out that they are protected in the neighbourhood of London, although after the sudden conversion of the London ringdove and the tameness of the London wild-duck, it is best not to prophesy.

"I do not know if you have noticed that there is no permanent close time for any wild bird under the present state of the law. A Bill is awaiting its turn [Mr. Russell is writing before the General Election] providing 'that the powers of the Secretary of State,' under the 1894 Act, 'may be exercised throughout the year as regards any or all descriptions of wild birds, and in respect of any particular month or months, and any particular day or days; provided that nothing herein contained shall vary or alter any provision of any Act relating to game.' This Bill might (if passed) be used to stop the Sunday plague of bird-catchers.

"It is to be hoped that the objects of the Field Club may soon be so far attained that people may take more pride in the protection of rare birds than in their destruction. The caretaker of a ruined castle, who kept pigeons which he would neither kill nor sell, used to give as his reason, 'when I die their wings will carry me to heaven!' The quaint thought contains a truth."

The above letter of Mr. Russell's, who from his official position is so well qualified to express opinions on the subject, contains so many interesting and valuable observations that no apology is necessary for quoting from it at length.

It remains to record two very important steps that have recently been taken with respect to the protection of wild birds within the Metropolitan districts of Essex and in the Epping Forest districts. At the meeting of the County Council on July 2nd, Mr. Russell's Committee reported that the Chairman and Alderman Buxton had attended a Conference held at the Guildhall, Westminster, on the 27th of May last, between representatives of the County Councils of Essex, Middlesex, Herts, and Surrey, with reference to uniformity of action being taken as regards these counties or parts of counties which are within the Metropolitan Police District, and in accordance with resolutions passed at the Conference the Wild Birds Protection Committee recommended that the Essex County Council should apply to the Secretary of State for an *Extension of the Close Time for Wild Birds as regards that part of the County which is within the Metropolitan Police District, so as to include the months of February and August.*

The Committee also recommended that the Council should apply for the following birds to be added to the Schedule to the Wild Birds Protection Act 1880, within the Metropolitan Police District, viz.:

Shrike
Kestrel
Wryneck
Swallow
Martin, House
Martin, Sand
Swift
Bearded Tit
Merlin
Hobby
Buzzard
Honey Buzzard
Osprey
Magpie

The Committee were not in favour of a general nesting area within the above-named district being asked for, but they recommended that application should be made for an *Order protecting the Eggs of the following birds (for a period of five years at first) within the Metropolitan Police District and outside the County of London, viz.:*

I. Birds in the Schedule to the Act 1880.

Nightingale
Goldfinch
Lark
Nightjar
Woodpecker
Kingfisher
Cuckoo
The Owls.

II. Birds proposed to be added to the Schedule to the Act of 1880. *(See list above on p.)*

III. Birds not in the Schedule to the Act of 1880, *nor proposed to be added to the Schedule, but the* Eggs *of which the Committee are of opinion should be protected*:

Wheatear
Stonechat
Winchat
Red Start
Pied Flycatcher
Spotted Flycatcher
Sedge Warbler
Reed Warbler
Blackcap
Garden Warbler
Wood Warbler
Willow Warbler
Chiffchaff
Whitethroat
Lesser Whitethroat
Long-tailed Tit
Nuthatch
Wren
Golden Crested Wren
White Wagtail
Pied Wagtail
Grey Wagtail
Yellow Wagtail
Hawfinch
Linnet
Corn Bunting
Cirl Bunting
Reed Bunting
Starling
Landrail or Corncrake
Coot.

The above recommendations were adopted by the County

THE ESSEX FIELD CLUB—*continued.*

The PUBLICATIONS of the Club [a full list of which was printed on cover of last number of THE ESSEX NATURALIST] have gained a somewhat high position because of their essentially *local* character.

The organ of the Club is now an illustrated periodical, entitled "THE ESSEX NATURALIST, BEING THE JOURNAL OF THE ESSEX FIELD CLUB," which commenced in January, 1887, and the ninth volume of which is now in progress. It contains papers read before the Club, or communicated direct to the Editor, Reports of Meetings, etc., and short notes treating of the Natural History, Geology, and Pre-Historic Archæology of Essex, and is sent free and post free to new members of the Club.

The Club has also issued two "Special Memoirs," viz., "REPORT ON THE EAST ANGLIAN EARTHQUAKE" (*the first book of the kind ever published in England*), and "THE BIRDS OF ESSEX," both being works of considerable importance, and which have been most favourably noticed by scientific journals. The third volume of the series, to be entitled "THE MAMMALS, REPTILES, AND FISHES OF ESSEX," will be published shortly, and an important county work, "THE BIBLIOGRAPHY OF ESSEX," is now in preparation.

The CENTRAL MUSEUM and LIBRARY is at Chelmsford, and a BRANCH MUSEUM to illustrate the Natural History and Archæology of EPPING FOREST, is being established in Queen Elizabeth's Lodge, Chingford, under the direct sanction of the Corporation of London. Fuller particulars of these institutions will be issued shortly.

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THE ESSEX FIELD CLUB.

(*Founded January* 10*th*, 1880.)

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The
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BEING THE

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OF THE

ESSEX FIELD CLUB.

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.
Honorary Secretary.

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Publications of the Essex Field Club.

In Volumes I. to III. the "Transactions and Proceedings" were combined, but Vol. IV. "Transactions" and Vol. IV. "Proceedings" were issued with separate title-pages. These five Volumes record the work of the Club down to December, 1886. In 1887 the "Essex Naturalist" was commenced.

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Edited by WILLIAM COLE.

This is the organ of the Club, containing papers and memoirs on scientific and antiquarian subjects especially relating to Essex, and numerous short notes on the Natural History. Geology, Prehistoric Archæology, &c., of the County, as well as reports of the Meetings of the Club. Most of the articles are of *permanent* value to all persons taking an interest in the progress of local scientific and antiquarian research.

The Editor will be glad to receive papers or notes for publication, if approved.

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All communications should be addressed to the Editor, Mr. W. COLE, Hon. Secretary, 7, Knighton Villas, Buckhurst Hill, Essex.

Council, and we may hope that the Secretary of State will sanction their adoption.

Finally we have great pleasure in noticing the very important steps recently taken by Mr. E. N. Buxton, one of the Verderers, and Vice-President of the Club, for the extended protection of several interesting birds within the Epping Forest districts. The scheme will be best explained in Mr. Buxton's own words, in a summary of a speech he made at a meeting of the Club at High Beach on May 18th, 1895. The matter will be more appropriately recorded in this place rather than in the account of the meeting :—

Mr. Buxton commenced by saying that he did not pretend to be a naturalist, except so far as he had used his own powers of observation. He was only a beginner, for he found that he learnt something new every time he went into the Forest. He was happy to say that Epping Forest was a sanctuary for all kinds of wild life, even for what is generally, in keepers' language, described as "vermin." The rule of the Epping Forest Committee was a strict one in this respect—that nothing shall be destroyed except by special order of the Committee, and then only if it is proved to be injurious. Thus, for instance, the rooks, which build in great numbers on the same island as the herons and quarrel with them for sticks, are limited in number for the peace of mind of that colony, and the deer, when they are complained of for eating the neighbours' clover, must be checked.

"It has occurred to me," Mr. Buxton continued, "that this sanctuary, which is 6,000 *acres in extent*, might be extended by the goodwill of the adjoining proprietors.

"The birds most in need of protection are those which are regarded by the gamekeepers, rightly or wrongly, as their enemies. I have been remarkably successful in enlisting the sympathy of nearly all the proprietors whose land touches the Forest in this little experiment [see list of estates joined in the league below]. I have however had, for the sake of unanimity, to limit the birds protected to a very modest list. They are as follows:

"All the family of Owls, all the Hawks (except the Sparrow-hawk), Magpie, Peewit, Heron, and Kingfisher. There is no doubt that the Owls in former times were regarded as friends by the farmers, for we find 'owl-holes,' left in the old barns that these birds might come in and out in search of mice. I should gladly have included in my list the Sparrow-hawk, and many of those who have combined will continue to preserve this interesting bird in spite of its murderous propensities. There is a pair at the present moment in my wood, as I know very well by the remains I have found of wood-pigeons and other birds. The mistake that the gamekeepers make is in confounding the harmless Kestrels with the rapacious Sparrow-hawk.

"The Magpie is another bird full of wickedness; but it has got so scarce in this neighbourhood that I am glad to be able to do something to prevent its total extinction. I know of three separate pairs this year in the immediate neighbourhood of the Forest. One of these is building at Wanstead.

"I would also gladly have included wild ducks, but I find that of our little society or league only those who never get a chance to shoot them were willing for this self-denying ordinance. Wild ducks breed in several parts of the Forest, and I know of one nest at the present moment in the heart of the Forest, at least a mile from any pond.

"As the result of my efforts, there is now safe asylum for the birds I have named over an area of nearly 20,000 acres; and it is obvious that this association for a common purpose may be extended in various directions, as, for instance, in combined steps against the bird-catchers who invade us in such numbers."

We feel sure that our members and readers will do all in their power to assist Mr. Buxton's admirable efforts. He has since issued a most attractive card, illustrated by Lodge with pictures of the Kestrel, Barn-owl, Lapwing, Kingfisher, Heron, and Magpie, which is intended to be hung up in Keepers' and Foremen's cottages, etc., as a perpetual reminder of the agreement entered into. The card is as follows:

"EPPING FOREST BIRD PROTECTION LEAGUE.

"Epping Forest is a sanctuary, nearly six thousand acres in extent, for all kinds of birds and animals. The adjoining Landowners have agreed to extend this protection, over their own coverts and lands, to certain birds in danger of becoming extinct or rare in the neighbourhood. The Birds agreed upon are as follows: All the family of the Owls, the Hawks, except the Sparrow Hawk; Magpie; Peewit; Heron; Kingfisher.

"The owners or tenants of the following estates or woods have agreed to instruct their Keepers to protect the above-named birds as far as possible: Gaynes Park; Bishops Hall; Loughton Manor; Warlies; Sewardstone Manor; Copped Hall; Woodreddon; Valentines; Hill Hall; Bitchetts; Birch Hall; Knighton; Highams; Chingford Hall; the Meadows adjoining Wanstead Park; Monkhams."[1]

We cannot but feel that the above record indicates a most satisfactory advance in public opinion on this matter to all true naturalists and lovers of Nature. It is hoped that the recommendations of the County Council will be confirmed by the Home Secretary, and thus that a working scheme for the protection of our most interesting birds may be inaugurated. Mr. Buxton's experiment will be watched with great interest, inasmuch as the area is larger probably than any other protected district in England. Everyone must have noticed the increase of many kinds of birds in the Forest since it was taken over by the Epping Forest Committee, and now that the outlying lands are to be brought under a similar beneficent rule with regard to birds, we may anticipate a still more rapid improvement. But all rules of the kind, whether put forward by public bodies like the County Council, or by private owners and custodians of open spaces, are almost useless without the intelligent co-operation of the public. We can only appeal to all to observe the rules, and induce others to do so—the object is a noble one, and all right-thinking people should do their utmost to render its attainment possible.

---

[1] A copy of this card, with an explanation of Mr. Buxton's scheme for the protection of birds in the Forest area, is hung up for inspection in the Epping Forest Museum at Chingford.

We shall report future progress in this matter from time to time in THE ESSEX NATURALIST.

NOTES—ORIGINAL AND SELECTED.

Slaughter of an Otter at Coggeshall.—In the papers it is recorded that on the evening of June 10th, an otter was discovered in the grounds at the "Mount," curled up in the stump of a tree and partly hidden by shrubs, by the side of the carriage drive, a few yards from the house. The gardener was attracted to the spot by a curious barking noise. The otter appeared quite at ease, and remained there until the Misses Surridge came up and had a look at it. In the meantime, Mr. E. T. Edwards (brave fellow !) procured a gun and shot the poor animal. It was a male in rather poor condition, weighing close upon 3 lbs. and measuring 2 feet in length. The place where the otter was concealed was at least two to three hundred yards from the river, and was about 8 yards from the high road and the house, and within a yard of the carriage drive. It would be interesting to hear of any other capture of a similar nature, as the otter must have crossed the high road to get into the garden.

A Flock of Swans at Galleywood Common.—In THE ESSEX NATURALIST, vol. v., p. 110, Mr. Henry A. Cole recorded a flight of Wild Swans over the Lea near Edmonton on January 19th, 1891. In "The Essex County Chronicle" it is stated that on Thursday afternoon, February 28th, a party of gentlemen shooting near Goat Hall Farm, Galleywood Common, were surprised about four o'clock by seeing a flock of eight fine swans flying over their heads at a long gunshot height. No shot was fired at them. The swans appeared to be coming from the direction of Ingatestone, and going towards the Baddow meads. [The birds in both cases were probably "Whoopers" (*Cygnus musicus*).—ED.]

An Eagle bringing up Chickens.—Those of our members who attended the meeting on the Chelmer river on August 8th, 1891, will remember seeing the Golden Eagle and her eggs at Mr. Garratt's, Hoe Mill, Woodham Walter (E. N., vol. v., p. 250). The history of the bird was given in the E. N. (vol. iv., p. 124) by Mr. E. A. Fitch. On April 10th, 1895, Mr. Garratt writes: "It may interest your readers to know that my golden eagle, which has been in captivity about twenty-eight years, laid her three eggs, as usual, last month. I took the eggs away and placed the eagle on nine ordinary hen's eggs. Yesterday (April 5th) she came off with five young chickens. She has not eaten them yet, and I believe she will bring them up."

Woodcock in Epping Forest.—Mr. F. H. Carruthers Gould states that on February 9th, 1895, he flushed a woodcock from the ditch behind the Bancroft School, immediately facing Whitehall Road, Woodford. "It was," he says, "evidently attracted there by the unfrozen state of a small drain. It speaks for the great distress of our wild birds during this severe frost, when so shy a bird as the woodcock is forced to seek its food so near human habitation." According to Mr. Buxton ("Epping Forest," p. 95), "the woodcock is not an infrequent visitor to the forest during the winter months," but, he adds, "the absence of springs and the hardness of the soil are unfavourable to them, and they are never numerous where cattle have access." They have been known to breed upon the forest, and many instances of their doing so in other parts of the county are recorded in the "Birds of Essex."—ED.

Occurrence of the Bearded Tit (*Panurus biarmicus*) and other Notable Birds in Essex.—I yesterday visited our local Bird-stuffer, Mr. Pettitt, and saw several birds in process of drying, which had been captured during this year and the last few months of 1894. Some of them may be worth noticing in THE ESSEX NATURALIST. There was one specimen of the Bearded Tit (*Panurus biarmicus*) which had been picked up dead on March 30th, 1895, near Harwich; one Norfolk Plover (*Œdicnemus scolopax*), shot at Earl's Colne in 1895; a Fulmar (*Fulmarus glacialis*), shot at West Bergholt, September, 1894; a Ruff (*Machetes pugnax*), shot September, 1894, at East Mersea; a Bittern (*Botaurus stellaris*), shot January, 1895, at Bures; and several Little Auks (*mergulus alle*), captured in various parts of the county in January of this year. Although none of these birds are actually very rare, the occurrence of the Bearded Tit near Harwich is of interest, as showing that this species still probably exists in the reed beds of our marshes.—HENRY LAVER, F.L.S., Colchester, April 25th, 1895.

Birds and their Persecutors.—In the "Nineteenth Century" for January, 1895, there is an article by Ouida on this subject, most of her remarks being on the destruction of birds in Italy. I remember, when at Naples in 1889, how strange seemed the almost total absence of birds in the environs, except in the grounds around an old Bourbon palace, where they had been accidentally preserved. The wanton destruction of birds of all kinds, large and small, is characteristic of all parts of Italy. Ouida states: "They are classed, in the Italian mind, with beetles, rats, and vermin generally." But they have, unlike beetles and rats, the reputation of being edible, and, though the Italians are said, by Ouida, to be "a nation without a palate," they draw the line somewhere between he eatable and the uneatable, as the fewness of birds and the abundance of lizards and bats in Italy sufficiently illustrates. But the most important fact in the article is a demonstration of the fact that this idiotic destruction of birds is not simply a local evil, though Italy is a special sufferer from the frightful increase of insect plagues. Ouida states that:

"The ornithophil societies of France and Switzerland have more than once written to me that unless birds be protected in Italy they must perish all over Europe, since so great a variety of races wing their way to the south in winter, and there are ruthlessly murdered."

Of the prospects of legislative action we learn:

"When the locusts appear in large swarms in some districts, as they did in Tuscany last year, there is, for the moment, loud talk of forbidding the capture and slaughter of birds for three or four years, but, unhappily, when the locusts go the fear of them goes also, the lesson which they taught is forgotten, and the measure is shelved. Over and over again has the project of enforcing an absolute preservation of all insectivorous birds been before the Chambers, been considered by ministers, and urged by prefects and syndics; but invariably it has come to nothing through the fear of displeasing the electorate and interfering with the pleasures of the mob."

The preservation of birds in the British Isles is usually one of the subjects discussed during meetings of the British Association at the Conferences of Delegates of the Corresponding Societies, but Ouida brings before us a matter not hitherto touched upon, I believe, at those Conferences, the desirability of co-operation for this end, not merely between the various districts of the British Isles, but between the nations of northern and southern Europe.—T. V. HOLMES.

Birds in the Winter.—Whenever we are passing through an unusually severe winter, paragraphs in the newspapers mention the abundance of seagulls far inland, and of shy, country-loving birds in town parks and suburban gardens. It appears to me that some interesting information about the habits of birds in winter would be obtained, if members of the Essex Field Club living in rural, suburban, and town houses, would not only throw out food, but would compare notes on the effects of severe weather when unusually prolonged, in attracting birds to their gardens not usually to be seen there. For example, my own house fronts Greenwich Park, and birds might fly to it from the fields around Eltham without passing any repulsive mass of houses. But while there is plenty of open space to the east and south-east, on the west the ground is mainly occupied with town houses and gardens. In mild or moderately severe winters, in which frosts are seldom thoroughly continuous for more than a week, the birds picking up food in my garden are mainly sparrows, though robins, thrushes, blackbirds, chaffinches, and great tits are not uncommon. But when a frost is severe and prolonged enough to allow of skating in the parks, two or three starlings appear, though I have never noticed any in mild winters or at other times of year, and become more and more numerous daily during the continuance of the frost. I counted one morning at the end of January a flock of between forty and fifty, all feeding at once, and quite outnumbering even the sparrows. Now blackbirds, thrushes, and chaffinches are all more commonly seen in severe winters than at other times; but, whatever the season, they come as individuals or in pairs, and not, like starlings, in a flock. It would be interesting to know what the experiences of other members are as to the birds which specially or solely visit their premises in the winter.—T. V. HOLMES, Greenwich Park, February 14th, 1895.

Coleosporium senicionis (FORMERLY KNOWN AS *Peridermium pini*).—A specimen of this fungus has been sent to me by our member, Mr. Rowland T. Cobbold, of Dedham. A Weymouth pine in his garden was so infested with this fungus that the ground was coloured yellow by the spores from it. This fungus is by no means common. It is, I am told, one of the fungi which proceed through an alternation of generations. It attacks, as "host-plants," one or more species of *Senecio* (*S. jacobæa*, *S. vulgaris*, etc.), upon which its spores develop into the form known as *Uredo senecionis*.—J. C. SHENSTONE, Colchester, May, 1895.

Ancient Mortar-stone or Corn-crusher and Roman Flue-tiles, from Epping Forest.—In reference to the globular stone which I exhibited at the meeting of the Club on February 24th, 1894 (E. N. viii., pp. 48, 49), the officials of the Society of Antiquaries have very kindly examined it, together with pieces of *tile*, which I have also found in the Forest. Mr. W. H. St. John Hope courteously writes me as follows:

"The flint-ball is a pestle or rubber for triturating meat or vegetables in a mortar, and is probably Roman, which is also the period of the pieces of flue-tile. We find many such balls yearly in our diggings at Silchester."

I have found broken pieces of these tiles in various parts of the higher ground in the Forest—High Beach, Leppitt's Hill, Warren Wood, etc. Mr. Charles Sworder has fine specimens of roofing tiles found at Epping (see E. N., vol. vi., p. 79.).

In Mr. Chancellor's interesting annual address, delivered on the 31st March, he refers to the probability of Roman residences having been in existence at such situations, and I believe that specimens of these tiles have been found by members in other parts of the Forest. Pattern markings are quite distinct on some of those I have found.—J. HAY WILSON, Chingford.

"Chapel-Henault" "Chapple-Hainault." A QUERY.—Whence comes the prefix *Chapel* by which a division or "walk" of the forest was distinguished? Does it refer to the ownership of any rights by an ecclesiastic body or to the site of some ancient chapel?—I. CHALKLEY GOULD, Loughton.

NOTES ON THE CONFERENCE OF DELEGATES OF THE CORRESPONDING SOCIETIES OF THE BRITISH ASSOCIATION, IPSWICH, 1895.

HAVING been present at the Conference of Delegates at Ipswich, as Secretary to the Corresponding Societies' Committee and as Delegate of the Essex Field Club, I have pleasure in forwarding the following notes on the proceedings of the Conference.

Having been elected President of Section B, Professor Meldola was unable to preside at the Conference, and Mr. G. J. Symons was consequently elected chairman for the Ipswich meeting. Following the precedent of the Oxford meeting, Mr. Symons opened the proceedings by the delivery of a short address. His subject was Meteorology, and he dwelt chiefly on those matters in which the Corresponding Societies could render assistance.

(1) In the first place he spoke of the necessity, as regards meteorological observations generally, of keeping records only from good instruments properly placed, an incorrect statement being worse than none at all. And he mentioned that the Royal Meteorological Society had published an illustrated pamphlet (price 1s.) called "Hints to Observers," which would show anyone how observations should be made.

(2) He treated of the desirability of records of sea and river

temperature, and described the work as easy, healthy, and inexpensive. The necessary apparatus would not cost more than twenty shillings.

(3) Earth temperature at shallow and great depths, is a subject that has long occupied the British Association. He thought that little more could be learned about temperature at depths between 10 feet, and 1,000 feet, at least in this country. But more records from depths over 1,000 feet were wanted. And, on the other hand, observations at depths from 3 inches to 10 feet might have much practical value in preventing the bursting of water pipes during severe winters.

(4) *Phenological work.* This, Mr. Symonds remarked, was a kind of work peculiarly adapted to local scientific societies, as it meant the tracing of the laws of the life-history of plants and animals.

(5) *Early meteorological records.* These, he thought, were often destroyed from ignorance of their interest and value, and he hoped the Corresponding Societies would do their best to preserve and publish them.

(6) *Records of river and well-levels*, and (7) *Records of floods and the placing of flood-marks*, were then touched upon. He stated that, as regards records of former floods and their utilisation in the way of warning owners of low-lying property, etc., the inhabitants of the British Isles were almost the most backward people in Europe. He hoped the Corresponding Societies would do something to forward improvement in this matter.

I should like to add to Mr. Symons' remarks on the desirability of records of temperature at shallow depths, that I hope recorders will note the nature of the soil or rock passed through as well as the depth. It may be of the utmost practical importance to know that to prevent water pipes from bursting during severe winters a depth of so many feet in a stiff clay is equivalent to so many of gravel or sand, sandstone, or limestone. And in a town, the nature of the pavement, and the "made ground," which often forms the uppermost 5 or 6 feet—more or less—must have its influence, and should consequently be noted.

As an example of the work to be desired in the registration of rainfall, Capt. G. R. Elwes laid upon the table a paper on the rainfall in Dorset, which had been compiled by Mr. Eaton, a member of the Dorset Nat. Hist. and Antiq. Field Club. It was a very careful piece of work, well illustrated by maps and diagrams. The chairman remarked that Mr. Eaton was an old friend of his, and that his work was an excellent example of the way in which the rainfall of a county should be shown. He wished similar records for every county could be obtained. Mr. Hopkinson stated that about twenty years ago he began to note the rainfall of Hertfordshire with about twenty observers. Forty observers were now at work upon it, the results being published in the "Trans. Herts. Nat. Hist. Soc."

His Honour Deemster Gill added that the meteorology of the Isle of Man was being well looked after, and that careful investigations were being made there with regard to coast erosion.

Mr. C. E. De Rance said that the increasing usefulness of the Corresponding Societies was illustrated by the fact that two Committees of the British Association, that on Coast Erosion, and that on the Circulation of Underground Waters, had just ceased to exist in consequence of the admirable way in which their work had been taken up by the Corresponding Societies.

Captain Elwes hoped that the Corresponding Societies would co-operate for the discovery of flint implements and the formulation of results.

Mr. Osmund W. Jeffs, Secretary to the British Association Committee for the Collection and Preservation of Geological Photographs, announced that the photographs collected would be placed in the Museum of Practical Geology, Jermyn Street. The first part of the collection, consisting of 800 photographs, had already been placed there. A vote of thanks to Mr. Jeffs for the valuable results already obtained was proposed and carried unanimously.

Mr. Murdoch (Glasgow) thought that Scotland had been excluded from too many investigations, and gave, as an instance, the B.A. Committee for recording the position, etc., of Erratic Blocks in England, Wales, and Ireland. It was, however, explained that the omission of Scotland resulted from the fact that the Royal Society of Edinburgh had been at work on the subject before the formation of the Committee. And at the second meeting of the Delegates it was stated that Scotland would be included in the labours of the Erratic Blocks Committee, as the work once done there by Mr. Milne Holme had ceased on his death.

At the second meeting it was announced by Mr. White Wallis that two Committees of the British Association, that for investigating Earth Tremors, and that for recording Seismological Phenomena in Japan, had been merged into one, with the title of "Committee for Seismological Observations," Mr. G. J. Symons being appointed Chairman, and Mr. C. Davison and Mr. J. Milne Secretaries of the new Committee. The Committee for the application of Photography to Meteorology were anxious to obtain photographs of lightning, rainbows, halos, etc.

As regards Geological Photographs, it was stated that Mr. Osmund Jeffs, the secretary to the Committee, had wished to resign, but had been persuaded to retain his post for another year, Mr. W. W. Watts having consented to act as co-secretary during that time, and afterwards to become sole secretary. Mr. Jeffs, however, would always be glad to forward any photographs that might be sent him, and to give information to any persons who might desire to help the Committee. And Mr. Sowerbutts hoped Delegates would remember that platinotype photographs were the best to send, as those printed by the bromide process often faded.

Some discussion took place on the desirability of an exchange of photographs between the Corresponding Societies, and the practical difficulties attending it. The best plan seemed to be that mentioned by Mr. A. S. Reid, according to which a photographer was appointed who received the negatives taken by members of a local society, and forwarded as many copies as were desired at a small fixed charge. Persecution of the amateur was thus avoided.

The amount and quality of the geographical teaching in schools of all kinds was discussed at considerable length. Mr. Sowerbutts (Manchester Geographical Society) stated that the General Committee of the British Association had been asked to permit the appointment of a Committee to examine into, and report upon, the teaching of geography in schools of every class.

Mr. Hartland, who appeared as the representative of the Ethnographical Survey Committee, mentioned the many ways in which the Corresponding Societies could render valuable assistance, and was warmly supported by the chairman, Dr. Garson. The work of this Committee is, indeed, unique in its variety. Besides physical measurements, and observations on the colour of the hair and eyes, etc., of the local population, there is a wide field for the amateur photographer, for those interested in folk-lore, linguistic peculiarities, place-names, local variations in tastes and habits, and the preservation of ancient monuments. As regards the last-named subject, Mr. Hartland stated that he had just received a letter from the secretary of a local committee in Pembrokeshire, who stated that some ancient stones and some pit dwellings had already been discovered there. Ancient monuments should be scheduled, described, and photographed. He hoped the Corresponding Societies would bring the labours of the Ethnographical Committee under the notice of their members. Some good work had been done by the Malton Naturalists' Society, and also at Ipswich. The Committee had a certain number of instruments, which they were willing to place in the hands of those who would undertake measurements.

Some discussion ensued, chiefly on the measurements required, which were by many speakers considered to be too elaborate. Mr. Hartland replied that though they hoped to get the measurements asked for in many cases, they were glad to obtain such measurements and photographs as could be procured.

The Chairman said that many schools had been doing good work in the measurement of school children, but, unfortunately, there had been no uniform system, so that the results at one school could not be compared with those at another. The committee concerned with the Measurement of School Children, after inquiring into the various systems practised, had drawn up one which it was hoped would prove acceptable. Prof. Windle, of Birmingham, would be happy to send a schedule of the various measurements required, and of the way in which they should be made.

The Rev. J. O. Bevan spoke of the desirability of expediting the archæological survey of the kingdom which had been begun a few years ago. It could not be too widely known that the Society of Antiquaries was willing to bear the expense of printing the maps, if they were done according to the regulations. The work would proceed much more rapidly if it were taken up energetically by properly qualified persons in the various districts.

The Conference then came to an end.

T. V. Holmes,
Hon. Sec. Corresponding Societies Committee;
Delegate Essex Field Club.

GEOLOGICAL NOTES ON A SUPPOSED EARTHWORK NEAR THE RAILWAY STATION AT HARLOW, ESSEX.

By T. V. HOLMES, F.G.S., *Vice-President.*

WITH A REPLY BY I. CHALKLEY GOULD AND FURTHER OBSERVATIONS BY T. V. HOLMES.

[THE following paper was read by Mr. Holmes at the meeting on the River Lea on June 29th, 1895. As Mr. Holmes traverses the conclusions arrived at in the original paper in the "Transactions of the Essex Archæological Society," we deem it only just to allow our valued member, Mr. Gould, to reply at the same time, and we have also appended some further observations by Mr. Holmes, written after perusal of Mr. Gould's reply.]

AT the beginning of this month (June, 1895), my friend, Mr. T. Hay Wilson, asked me to go with him to Harlow to see some new sections in Glacial Drift in that neighbourhood. I did so, and as we left Harlow Railway Station, he pointed out the supposed earthwork, and was also good enough to lend me a short paper thereon, by Mr. I. C. Gould, which had been read before the Essex Archæological Society on May 17th, 1894, and since published in "Trans. Essex Archæological Society," vol. v. (n.s.), pp. 95-98, with plate. Mr. Gould, in concluding his paper, remarks: "Having thus touched upon the various possible dates of the construction of this earthwork, the question arises, to what are we to attribute it? I *suggest* that we have here a natural oblong hill turned into a fort, which was in its origin British."

And he then discusses in what ways the "fort" or "earthwork" may have been modified by races occupying the district at later periods.

Mr. Gould notes that an account of the discovery of Roman remains at Harlow, together with a brief notice of this earthwork, may be seen in the "Archæologia" for 1821, p. 409; also in the "Gentleman's Magazine" for the same year, part i., p. 66. In the "Gentleman's Magazine Library," no mention is made of anything at Harlow in the two volumes devoted to "Archæology," or in those treating of Romano-British antiquities. And in "English Topography," part iv., though there is a notice headed "Harlow," in the portion assigned to Essex (p. 118), there is no mention of this earthwork, though there is some account of the discovery, in 1841, of six coffins during some excavations which had recently been made near Harlow by the railway company. But these coffins, with their contents, though apparently of ancient date, were found (judging from the account given) in the cutting east of the Railway

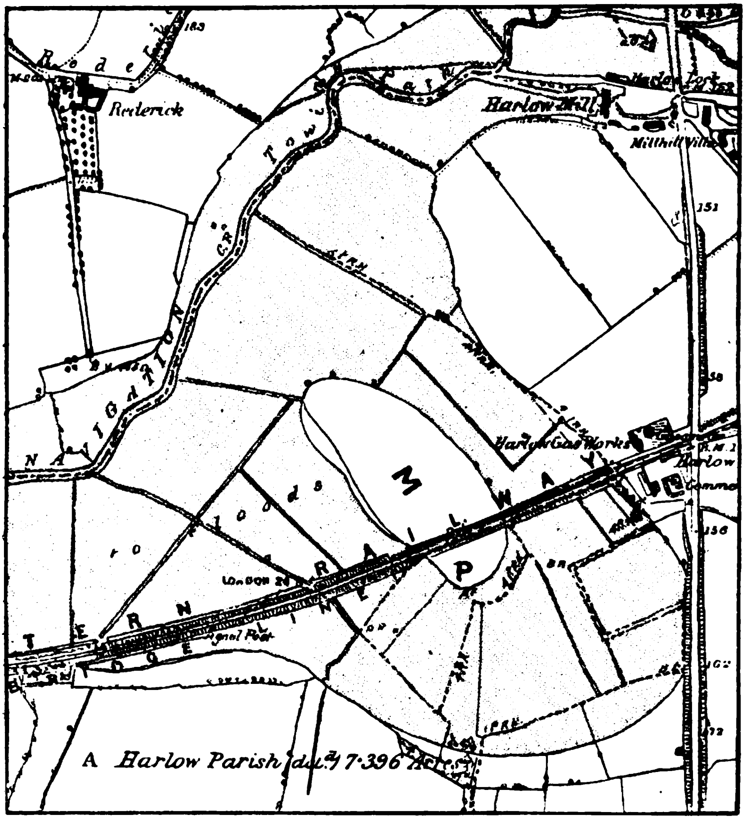

Fig. 1.—Portion of Six-inch Ordnance Map (41 Essex) of the Harlow District (*with additions*), showing Position of the Supposed Mound. *The Alluvial Flat is indicated by the grey shading; M is the Mound, and P indicates the Position of the Pond.*

Station, near Harlowbury, while the earthwork I am now considering is on the west.

The accounts given in the "Gentleman's Magazine" for 1821, and in "Archæologia" for the same year, are of about equal length, and the lists of Roman or Romano-British antiquities found are nearly identical, and evidently refer to the same collection.

Mr. Gould, in his paper, gives the whole of the "Gentleman's Magazine" account, but only mentions the date of that in "Archæologia." The descriptions of the supposed earthwork are equally brief in each case, and are as follow. In "Archæologia" we read:

> "There is a field called Standing Groves, situated a mile South (*sic*) of this town, near the river Stort, of an oval form, rising gradually all round to the centre, about 20 ft. high. In digging into this hill, a few years since, the workmen discovered some very strong walls, which they were not able to penetrate."

In the "Gentleman's Magazine" the account is as follows:

> "Near Harlow, Essex, are the remains of a Roman station, not yet noticed by Antiquaries. The *castellum*, or place of strength, appears to have been in the neighbouring parish of Latton on an elevated field, which was formerly almost surrounded by the waters of the river Stort. The works are not now visible, but a few feet below the surface are the foundations of very strong walls."

There is an obvious misprint in the account in "Archæologia" in the use of the word *South* instead of *North*. And the distance from the town is too great. The mound is about half a mile N.N.W. of the centre of the town, which is small and very compact in form.

The supposed earthwork is shown on the map of the Geological Survey (47 S.W.), as consisting of London Clay and as surrounded by the alluvium of the Stort. Above the alluvium it rises in the centre to a height of about 25 ft. It stands about 300 yards west of Harlow Railway Station, and is about 400 yards long, its greatest breadth being about 180 yards. Its plan is oval, and it is correctly described in "Archæologia" as "rising gradually all round to the centre." The longer axis of the oval has a direction nearly north-west and south-east (See Map, Fig. 1).

The geological formations visible at the surface within a radius of two or three miles round Harlow, are the London Clay, the Glacial Sand and Gravel, and the Boulder Clay; the first-named occupying a very small space here and there in the river valleys; the second a much larger area in the flanks of the valleys; and the third capping the plateaux between the valleys. Through these strata the Stort has cut its way, and is now, after the fashion of rivers, continually tending to change its course laterally, to eat away the bank on one side of its channel, and to deposit alluvium on the other, where the current is sluggish. It is not uncommon to find here and there, in the course of rivers like the Thames and Lea, an alluvial island dividing the stream into two channels for a short distance. But present or past islands consisting of high ground surrounded by alluvium, such as the mound we are considering, are comparatively rare, and are consequently much more likely to be thought artificial than stream-surrounded portions of alluvial flat.

It is evident that the Stort at one time, instead of flowing north and west of this oval mound, as it now does, swept round between it and the Railway Station in a south-easterly direction, and then turned sharply round towards the north-west, as shown by the alluvium. At that time the mound was the south-eastern end of a promontory of high ground stretching from the north-western end of the present mound towards the house called Rederick. Then (as so often happens where a river, making a horseshoe-shaped bend, almost encircles a tract of land) the high ground between the present mound and Rederick became thinner and thinner, being eaten into by the Stort, both above and below its south-easterly bend. At last the stream broke through the narrow isthmus of high ground connecting the mound we are considering with the high ground towards Rederick. It then gradually deserted its old channel south of the mound for a more direct passage north of it, while its meanderings, since it took its present course, have reduced the mound to its present length.

The two best examples that occur to me as illustrating this tendency of rivers to cut through the isthmuses separating their channels, on the upper and lower sides of their horseshoe bends, are on the Severn at and near Shrewsbury. Close to Shrewsbury, on its north and north-west side, the Severn has entirely deserted an ancient bend northward, and made itself a more direct channel from west to east. I am informed that water may still sometimes be seen in the old channel in times of flood. From the high banks on both sides of this old channel it forms a very striking feature, except where the encroachments of the builder prevent a good view of it being obtained. The other case is four or five miles above Shrewsbury, at a spot called the Isle. There the Severn still makes a most circuitous bend northward, though the isthmus dividing its channels above and below the bend is reduced to extremely small dimensions (See Fig. 2). And it is obvious that sooner or later the river will inevitably take a more direct course by cutting through the isthmus at (A).[1]

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[1] The River Waveney makes a similar bend around Bungay.

Thus there can be no doubt that this supposed earthwork at Harlow is a natural mound, the result of the circumdenuding action of the Stort, or, as Mr. Gould suggests, "a natural oblong hill." But I would add that there seem to me to be no signs that it has ever been modified to form an earthwork. From the road, a few yards north of Harlow Railway Station, Mr. Wilson and I had an excellent view of the outline of the hill, and I was much struck by the fact that its contour suggests that it is simply a natural hill of London Clay. Indeed, it seems impossible to me that its shape should ever have been modified by man, except possibly to the most trifling degree; certainly not to the extent implied by the formation of a defensive earthwork.

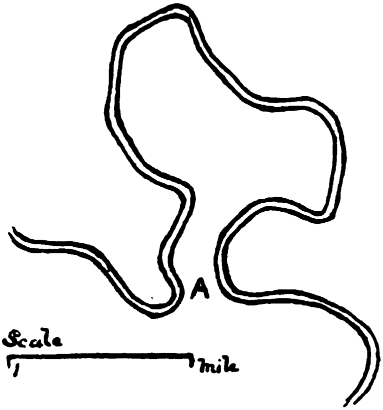

FIG. 2.—THE SEVERN AT THE ISLE. (*From the Ordnance Map.*)

The outline here given will sufficiently illustrate its contour, as seen from the spot mentioned, though the height is somewhat too great in proportion to the length. And anyone who compares it with the outlines of unmodified London Clay hills elsewhere will see at once the perfect resemblance between them (Fig. 3).

On walking all round the hill, a few days later, I saw nothing to give a different impression. All round its base was an ordinary ditch, here faintly, there clearly marked, just where one might expect to see a ditch or hedge, or both, along the line of junction between the London Clay hill and the alluvial flat. At the base of the hill, at its north-western end, there was possibly a trace of an old river terrace. At the south-eastern end there seemed to be a pond of no great size, at the edge of the alluvial flat, though it was dry from the want of rain. But I saw nothing to suggest anything but farmer's work for farming purposes.

We have seen that both "Archæologia" and the "Gentleman's Magazine" mention the existence of the foundations of very strong walls somewhere about this hill. But neither writer seems to have seen them or to know whereabouts they were placed. And it is much more likely, it seems to me, that they were the remains of old farm buildings, rather than part of any ancient military structure. For any kind of fortress, pre-historic, Roman, or mediæval, must have left its mark on the contour of the slopes of the hill. If, again, we look at the positions of the neighbouring camps mentioned in "Archæologia" and the Gentleman's Magazine," and compare them with that of this Harlow mound, we find that they really increase the evidence against the supposition that the latter was ever a fort. For the ancient fortresses at Walbury and Stansted Mountfitchet are both on Glacial Gravel, while the Castle at Bishop's Stortford is close to the river, at a spot where the alluvial flat is very narrow. In each of these three cases their artificial shaping is very manifest; in each a good water supply was obtainable. The Bishop's Stortford Castle Mound is, of course, the only one of the three with which the Harlow Mound can fairly be compared, but the visitor to the two mounds will soon see that any resemblance between them is of the most superficial kind. They both rise from the alluvial flat of the Stort, and there any likeness between them ends.

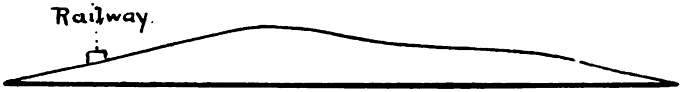

FIG. 3.—OUTLINE OF THE HARLOW MOUND. (*From near the Railway Station.*)

The Harlow mound is 400 yards long, that at Bishop's Stortford may be 60 to 70 yards. Then, as we have seen, the former is an extremely slight and gentle eminence, its height being about 25 feet at its highest point above the alluvial flat, and its contours perfectly natural. The Bishop's Stortford mound, on the other hand, instead of presenting natural contours, is as steep-sided as any railway embankment, and equally suggests an artificial origin. Its height, too, is considerably greater than that of the Harlow mound. It is so covered with trees as to be difficult to estimate with precision, but it must rise 35 or 40 feet above the alluvial flat at its base. It is obvious, too, that the Bishop's Stortford mound, from its closeness to the river, both commanded that stream and a water supply from it, while the Harlow mound is not well situated, either for military purposes or for water supply. For no water is obtainable from the London Clay, and that from ditches or ponds on the edge of the alluvial flat would often be small in quantity as well as bad in quality. In addition, a supply from the distant Stort would have been liable to interruption at the hands of an enemy in primitive times.

On the other hand, the Harlow Hill would afford pasturage for cattle when the alluvial flats surrounding it were more or less flooded; and as floods largely occur in winter, when cattle need more or less shelter, some farm buildings may at one time have existed on the hill. Though people in all ages preferred gravel or some other permeable rock as the site of a town or village, yet many isolated farmhouses and cottages may still be seen, the inhabitants of which derive their water supply from ponds. On June 8th I visited a spot near Chelmsford where a well was being sunk, by order of the local authorities, to supply some cottages with water of better quality than that which they were then getting from ponds once probably marlpits.

In conclusion, it may be useful to sum up my remarks on the Harlow mound or hill. (1) It has been produced simply by former changes in the course of the River Stort. (2) Its contours are those of a natural hill of London Clay, on which no earthworks for defensive purposes have ever been constructed. (3) Its position and soil must always have made it unsuitable for a fort of any sort. (4) It is by no means improbable that it may once have had on it farm buildings of some kind; and the foundations of strong walls, said to have been discovered on it, may have belonged to them.

A REPLY.

By I. C. GOULD.

A LARGE portion of my esteemed opponent's paper is devoted to his views as to the shaping of the hill by a natural shifting of the course of the River Stort. This is of the greatest importance; but, whether right or wrong, is without any bearing upon the archæological question. In my paper I suggested that "we have here a natural oblong hill"; so far we agree, but I claim that there is evidence of man's occupation, and that at a time when occupation necessitated defence.

Roman coins, pottery, etc., reported to have been found, show occupation during the Roman period; but the whole work is too small to render it probable that the Romans originated a military station here. I conclude, therefore, that it existed as an occupied post before the Roman settlement. Its dangerous position, in what (I believe) was the borderland of the Trinovantes, would make it impossible for its occupiers to exist without fortifications; but, as the place was practically almost an island in those days, the additional defences may have been mainly of wood, which would have perished long since.

Guided by the views of the great authority, Mr. Clark, as expressed in his "Mediæval Military Architecture" (1884), I suggest that it is possible that the shape of the lower portion of the mound, on its N. side, was the result of some reconstruction to suit the common form of Saxon or Danish fortified home. Whether this is so or not, does not affect the question of the earlier occupation of the whole work.[2]

In addition to the evidence afforded by coins, we must note:

(1) The dyke which surrounds the enclosure. Mr. Holmes says it is an ordinary farm ditch just where the alluvium joins the base of the hill. Permit me to say that in more than half of its length it is not where the alluvium appears to commence, that in part of its course it is a dry dyke taking a form (often seen in early works) suggestive of a road rather than a ditch, that it slightly ascends the side of the hill on the E., and that in another part it is thirty feet wide. Surely this is not an ordinary farm ditch at the base of the hill.

(2) The sunken way, part of the dyke, on the S.W. must have been subject to much traffic, or have been intentionally lowered for the purpose of defence from the banks. Again, where the road to the mound passes down from the high land to the marsh level it is sunk some 8 feet. Man's handiwork, or very considerable traffic alone, can account for such a depression; part of it being cut through rising ground, water cannot have accomplished this. It is *possible* that the road led by the hill to some ancient, long-forgotten fordway

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[2] In suggesting that possibly the high mound was thrown up in the Saxon period, I did not, of course, mean that it was thrown up from base to summit; but simply added to by earth from the lower part. This meaning would be evident from my reference to the whole as a "natural oblong hill."

across the valley; if so, the *raison d'être* of the earthworks would be evident.

(3) Tradition long ago appears to have assigned a fort or other mysterious purpose to the hill. The tradition found voice in the "Gentleman's Magazine" in 1821, when the mound was spoken of as a *castellum*, "formerly almost surrounded by the waters of the Stort."

The tradition has its echo to-day in a remark made by an aged labourer: "I allus heard there was summat in it." Such tradition can hardly be the work of nature.

(4) In 1821 the foundations of strong walls were referred to. Mr. Holmes says that "granting their existence," they were probably farm buildings where the railway is now, or at the S.E. corner of the inclosure. I need only say that I found them on the summit itself, and that if Mr. Holmes had conversed with labourers who have taken horses and carts over the hill, he would probably have heard something that would have shown that it is not alone by the contour of the hill that the archæological question can be judged.

Mr. Holmes says that the earthwork is not referred to in the "Gentleman's Magazine Library," but as it is in the "Gentleman's Magazine" (1821, part i., p. 66), surely the reference to the original was sufficient.

I need not deal with the comparison between the Bishop's Stortford and the Harlow mounds, as (though the "Gentleman's Magazine" article links them together) I did not suggest any connection between them, and they are distinct in form, site, and physical conditions.

Perhaps Mr. Holmes's strongest point against the occupation of the Harlow hill is the (asserted) want of water. In this he is mistaken.

The next hill, lying N.E. of the mound, is at a short distance, say 500 ft. That hill contains boulder clay, with brick-earth against its eastern side and much gravel on its western slope; the water from this gravel appears to have found its way to a brooklet which branches at a point about 375 ft. from our hill. From that point there is a cut, possibly artificial, which brings the water to the dyke at the base of the works; in fact, to the place which it would be easy to defend from the outworks.

Small hill-forts, or fortified sites of residences, had occasionally to depend upon outside arrangements for water supply. I recall one instance in Montgomeryshire (between Llanymynech and Llanfyllin), and another in Radnorshire (between Builth and Llanfihangel), in which, if I remember rightly, no water appears to spring within the works, but in each case a brook is at the foot of the slope.

But in the case of the Harlow hill, there is evidence not only of a supply of water from outside, but of a pond or reservoir on the earthwork itself! Just below the lower court or terrace are the remains of a pond, provided with a ditch to carry the surplus water to the deep dyke on the N. of the works.

I do not claim to be a geologist, and hesitate to raise a question in that field against so redoubtable a champion; but, as a mere layman, I would ask if, as Mr. Holmes says, the hill is all London Clay, whence comes the water to this pond, which is some feet above the alluvial ground of the marsh?

FURTHER REMARKS ON THE ABOVE PAPERS.

By T. V. HOLMES.

SINCE the foregoing notes were read at the meeting of the Essex Field Club, on the River Lea, June 29th, I have been favoured with a sight of Mr. Gould's reply to them. It seems best to notice here, as briefly as possible, the points brought forward by Mr. Gould.

He remarks, in the first place, that my explanation of the way in which this Harlow hill was shaped, by a change of course of the Stort, has no bearing upon the archæological question. But as Mr. Gould has no explanation of any kind to offer on this fundamental point, and as the writers in the "Gentleman's Magazine," and "Archæologia," quoted by him, were evidently ignorant of the explanation given, it became necessary to bring it forward. It would have been absurd to consider other questions without settling that one first.

The discovery of Roman coins on the hill would show nothing as to its occupation.[3] Coins may be found anywhere. They were buried in thousands of places by thousands of people, from the earliest periods up to the present day, and are as likely to be found near an old tree as an old house. Besides, the question is whether this Harlow hill is an ancient earthwork or *castellum*, on which coins can tell us nothing.

Then, as to the ditches at the base of the hill, Mr. Gould seems to think that because one of these ditches keeps for some distance a few yards above the level of the flat, it cannot be an ordinary farm ditch. To me it is evidence that it *is* one; for while nature gives a more or less curved line to boundaries of a geological kind, farmers tend to straight lines in their hedges and ditches. Thus the two seldom coincide for more than a very short distance. On the other hand, a ditch for defensive purposes would naturally have been made to keep to the border of the alluvium, in order to be uniformly full of water, would have been very broad, and would have had an earthen rampart on its inner edge, consisting of material thrown up out of the ditch.

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[3] I do not gather, however, from "Archæologia," and the "Gent. Mag." that any have been found on the hill itself.

My inference from the absence of any mention of this Harlow hill in the "Gentleman's Magazine Library," is simply that the learned editor of that useful series of volumes has not thought its archæological interest sufficiently well-established. For an antiquary of 1821 was *capable de tout* in questions of this kind, and ready to jump at any conclusions. Consequently, I should not have thought the matter worth writing about had not an accomplished archæologist like Mr. Gould adopted similar views in 1894. I cannot see the slightest evidence that this Harlow hill was ever fortified by earthworks. The surface of the hill presents perfectly natural contours, which have never been modified artificially. The foundations of walls were, I think, simply those of farm buildings, as, had they belonged to a fortress, the fosse and other earthworks would have remained when the walls were removed to make others elsewhere, just as in the case of so many ancient castles whose sites are now marked mainly by their earthworks, as at Stansted Mountfitchet.

Mr. Gould appears to object to a comparison between this supposed earthwork at Harlow and the unquestionable one at Bishop's Stortford. But, surely, as the two both arise from the alluvial flat of the same river, and are only six miles apart, no test can be fairer or more decisive. And I think that any visitor to them cannot fail to recognise the fact that their differences are not of degree but of kind. And that what the one is the other is not.

The question of water supply to the Harlow hill is quite a subordinate one. It is almost certain that a specially good and commanding site would be occupied by an ancient earthwork, even though the water supply might be indifferent or precarious. But the Harlow hill offers no advantages of position and height. As regards its water supply there would, of course, be no difficulty in obtaining water from ditches on the edge of the alluvial flat, and pits on the hillside would *hold* rain-water, though no water could be obtained from wells in the London Clay.

People from the earliest times have always preferred gravel sites where possible, as at Walbury, where gravel overlies the London Clay, and the water, percolating through, is obtainable by means of wells. Popular opinion has always strongly preferred well-water to that from stagnant ponds or marsh ditches. From the book by Miller and Skertchly on the Fenland, we learn (p. 417) that "in the parish of Houghton almost the only family which escaped ague at one time was that of a farmer who used well-water, while all the other persons drank ditch-water." But in the Fenland water from wells is rarely obtainable, while in the Stort valley it may be had almost everywhere, the Harlow hill being quite exceptionally unfortunate as regards a good water supply. However, the drift of my remarks is primarily to point out that it is a natural hill which shows no signs of ever having been entrenched. It seemed worth while, in addition, to note other things showing it to be not the kind of site on which we might expect entrenchments to exist.

GEOLOGICAL NATURE OF THE LAND THAT HAS FALLEN OUT OF CULTIVATION IN ESSEX.

ON the occasion of a visit of the Geologists' Association to Chelmsford, on June 8th (1895), Mr. T. V. Holmes, the director, read the following notes on the geological character of the land which had fallen out of cultivation in the Ongar, Chelmsford, Maldon, and Braintree Districts. They had been kindly sent by Mr. H. W. Monckton, F.G S., who found himself unable to be present. Mr. Monckton remarked :—

"The report on the Ongar, Chelmsford, Maldon, and Braintree districts of Essex, by Mr. Hunter Pringle, published as a Blue Book, was largely referred to in the House of Commons during the debate on agricultural depression on July 11th, 1894.

"The map attached to it is of special interest to dwellers in south-east Essex. On it the fields which are alleged to have gone out of cultivation since 1880 are marked as black patches.

"To one acquainted with the district, it is apparent at a glance that the black patches are mainly at places where the London Clay forms the surface of the ground.

"At the north-east corner of the map there is a tract covered with Chalky Boulder Clay quite free from black patches.

"Between Chelmsford and Maldon there is a considerable extent of gravel and alluvium, and on it there are not many black patches excepting in places where the gravel is thin, and the London Clay which underlies it is near the surface.

"There is a small black patch on Bagshot Sand and Boulder Clay at Frierning, and one on gravel on the hillside between that place and Ingatestone. And between Woodham Ferris and Bicknacre Priory there are several black patches on Boulder Clay and loamy gravel.

"South of Woodham Ferris there is a large black patch on the alluvium of Woodham Marsh, and there is another on the alluvium of Hadleigh Marsh. All those south of the railway from Pitsea to Benfleet are on alluvium.

"At the eastern end of the map there are some black patches on gravel and alluvium. Near Hadleigh there is one on Bagshots, and there is one near Mucking on various formations; but with these exceptions the black patches are on London Clay."

Mr. Monckton noted, in addition, an extraordinary statement in paragraph 10, p. 36, of Mr. H. Pringle's Report, as follows, remarking that "it is seldom one meets with a statement more hopelessly inaccurate; it is not even correct of the solid geology":—

"The soil of Essex, with the exception of two small patches, is geologically classed as London Clay."

Mr. Holmes adds to the above that "surely the author of this Report should have known of the existence of the Drift Maps of the Geological Survey. The latest published, that of sheet 47, appeared in 1885, the others earlier. And the Drift Maps show that north of a line drawn from east to west through Chelmsford the London Clay, where it exists, occupies but a very small proportion of the surface. While, as its outcrop, against the Glacial Drift, is along a line from Bishop Stortford to Sudbury, it is not to be found, either at or below the surface, over a good many square miles of north-western Essex."

Richard Earl of Tilney

ORDER is taken this 14th day of January 1741. By Virtue of his Majesty's General Letters Patent Dormant bearing date the 22d day of June 1727. That you deliver and pay of such his Majesty's Treasure as remains in your Charge unto Richd Earl of Tilney Warden of his Majesty's Forest of Waltham in the county of Essex or his Assigns the Sum of Sixty seven Pounds ten Shillings without Account to be by him distributed and paid over in the Proportions following amongst the Rangers, Keepers and other Officers of the said Forest for the quarter ended at Ladyday 1741. Vizt

£ s d
lxvii,,x,,—

£		£ s d	
10 p.ann	To the Chief Ranger	2:10:0	
20	To the Woodward and Keeper of the Woods within the Walk of Chapel Henault	5:0:0	
20	To the Underkeepers of the Walks of Walthamstow . .	5:0:0	G Earle
20	Leighton and Holme Frith .	5:0:0	
20	Loughton	5:0:0	
20	Woodford Lodge	5:0:0	Geo: Treby
20	New Lodge	5:0:0	
20	Lambourne	5:0:0	Tho Clutterbuck
20	Chinkford	5:0:0	
20	Epping	5:0:0	
20	East Heneault	5:0:0	
20	West Heneault	5:0:0	
40	To the four Underkeepers of the said Forest to be equally divided amongst them	10:0:0	
		£: 67:10:0	

And these together with his or his Assigns acquittance shall be your Discharge herein

Exr P Walpole

A FOREST DOCUMENT OF THE EIGHTEENTH CENTURY.

By I. CHALKLEY GOULD.

As considerable interest was manifested in the Order (shown on the opposite page) when it was exhibited at our meeting at Stratford, on March 9th, 1895, I have the pleasure to record a few remarks then made.

It is an Exchequer Order of George II., dated the 14th day of January, 1741,[1] relating to the payment of a quarter's salary to certain officials of our forest. The amount is £67 10s., to be disbursed by Richard Earl Tylney. This earl was the Sir Richard Child who, in 1715, erected Wanstead House, little dreaming that his white stone palace would be utterly wiped out of existence in little more than a hundred years.

The first payment is to the Chief Ranger—at that time John Goodere, Esq. As the annual emolument was but £10, it is not easy at first to see why county magistrates, such as Lord Castlemain, John Wroth, Sir William Smijth, and others, cared for the office, but privileges and perquisites were probably attached to the position, for we find Sir William Smijth, in 1788, claimed the right to one buck and one doe annually from each "walk" of the forest.[2]

The duties of the Chief Ranger appear to have been exercised, not so much inside of the forest (as would be supposed), but rather in the purlieus on the borders thereof. Mr. Fisher tells us that the Rangers and Under-Rangers were sworn to "re-chase, and with their hounds drive back again, the wild beasts of the Forest, as often as they should range out of the Forest into their purlieus," etc.—an arrangement originally made, not so much in the interest of the farmers, whose crops would suffer from the deer, as for the sake of the recreation of those royal personages and others who enjoyed the pleasures of the chase in the woodland rides.

Our document next orders the payments of the woodward and keepers of the various "walks," and of the four under-keepers of the forest. The list is interesting as giving a somewhat different arrangement of walks from those referred to in

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[1] Prior to the "change of style" the year ended in March in all legal and official documents.

[2] Fisher (W. R.), "The Forest of Essex" (1887), p. 166.

"The Forest of Essex" (1887) as existing in 1630, '31, '34, or 1713.

At the foot of the page appears the *per pro* signature of Walpole, the well-known statesman, who lost his offices of First Lord of the Treasury and Chancellor of the Exchequer in 1742, when, by way of consolation, George II. made him Earl of Orford.

On the other side of the leaf we find: "My L$^{d.}$ Macclesfield I pray this order out of Letter Money." Then follow other names and the receipting signature of the Earl "Tylney."

[Mr. Gould has kindly presented this interesting document to the Club's Forest Museum at Chingford.—ED.]

THE MANAGEMENT OF EPPING FOREST.

MEMORIALS TO THE COMMITTEE, AND SECOND OFFICIAL REPORT OF THE EXPERTS.[1]

THE bitter agitation carried on in the spring of 1894, in protest against the thinnings which had been made by the Conservators in Lodge Bushes, Bury Wood, Monks Wood, Epping Thicks, and many other parts of the Forest, was dwelt upon in detail in the last volume of THE ESSEX NATURALIST.

Those acquainted with the facts, and with the former condition of the Forest, quite thought that the Report of the Experts, dated June 7th, 1894, had effectually disposed of and answered most of the objections to the forestal operations of the Conservators. But with the renewal of the cutting in the winter of 1894-5, fresh outcry arose, and speedily assumed somewhat alarming proportions; certain of the press taking the matter up, and the wildest assertions and suggestions were made by writers, many of whom plainly showed that they were new to the subject, and were not conversant either with the history of the Forest, or its present state. The agitation may be said to have culminated in a meeting held at Wanstead, at which a resolution was passed asking the Conservators to forego any thinning operations for five years! To many friends of the Forest, both within and without the Club, the suggestion caused the deepest anxiety, as in their opinion such a course of action would be simply disastrous to the future growth of the Forest. Two counter memorials were accordingly prepared, one from gentlemen interested generally in the Forest, and who *had recently visited it*, and the other from Forest residents. These memorials are set out (together with the resolutions, alluded to above, from the Wanstead Meeting) in the subjoined Report of the Epping Forest Committee to the Common Council, dated June 13th, 1895:—

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[1] As before, we print the text of these Reports in their entirety, as they will be valuable documents for future reference in connection with the history of the Forest, and such papers are apt to become rare and inaccessible. The reader is referred to the former Report set out also in full in an article on the "Management of Epping Forest" in THE ESSEX NATURALIST, vol. viii., p. 117.—ED.

To the Right Honourable the Lord Mayor, Aldermen, and Commons of the City of London, in Common Council assembled.

WE whose names are hereunto subscribed, of the Epping Forest Committee, to whom on the second day of May last it was referred to make a Special Report to your Honourable Court with respect to the charges of undue and unnecessary cutting of timber in the Forest, have the honour to certify that, on the 4th and 11th days of May last we visited the Forest and carefully viewed the various sites in respect of which complaints of excessive thinning had appeared in the Public Press. We failed to find justification for the attack which had been made; on the contrary, we discovered many instances of gross exaggeration. We, subsequently, invited the attendance of some of the principal complainants, and, at a meeting held on the 13th May last, we were attended by a Deputation consisting of—Mr. J. E. Cockett, Mr. Percy Lindley, Mr. Bernard Gibson, Mr. H. E. Kayer, Mr. A. H. Tozer, Mr. W. P. Forbes, and Mr. E. E. Cockett; which Deputation asserted that the thinning had been excessive, and urged us to give the Forest at least five years' rest, and they laid before us copies of the following Resolutions on the subject, passed at a Public Meeting held in the Drummond Room, Wanstead, and at a Committee Meeting held on the 8th May last, namely:—

Copy of RESOLUTIONS passed at a Meeting held in the Drummond Room, Wanstead:—

1. That this Meeting hereby records its deep regret that during the last few years so many thousands of trees have been cut down in the Forest.
2. That a Committee be now formed to confer with the Epping Forest Committee with a view to ascertaining what arrangements are now to be made for the preservation of the growing trees, the planting of open spaces, and the drainage of certain parts of the Forest.

Copy of RESOLUTION passed at a Committee Meeting held on 8th May:—

This Committee, consisting of Commoners and Residents in Loughton, Chigwell, Woodford, and Wanstead Parishes, and others interested in the preservation of the Forest, desire to call the attention of the Epping Forest Committee to the very large extent to which the thinning of the underwood and felling of trees have taken place during the last few years, and to express the opinion of a large number of residents of the Forest Parishes that it is desirable, in the interests of the preservation of the natural aspects of the Forest (as provided by the Epping Forest Act, 1878, clause 3), that instructions should be at once given for such thinning and felling to cease; and that for a period of five years only dead trees should be removed.

We thereupon resolved that the five gentlemen who acted as Experts and reported upon the subject last year should be asked to visit the Forest again, and report how far the thinning which took place during last winter was carried out in accordance with their recommendations.

Mr. Solicitor has been in communication with those gentlemen, all of whom (with the exception of Mr. Robinson[2]) are willing to comply with our request; but, owing to various circumstances beyond the control of your Committee, it has unfortunately been found impossible to arrange a meeting earlier than the middle of July next. We regret, therefore, that we are unable, at the present time, to report fully to your Honourable Court on the subject.

At a meeting of this Committee held on the 10th instant, we were attended by a deputation consisting of the following gentlemen :—

Mr. Andrew Johnston (Chairman of the Essex County Council, and a former Verderer of the Forest), Professor Meldola, Professor Boulger, F. Carruthers Gould, Esq., Horace T. Brown, Esq., F.R S., Sir Robert Hunter, William Cole, Esq., H. Joslin, Esq. (High Sheriff of Essex), Professor Stewart, and F. Chancellor, Esq. (Mayor of Chelmsford); who presented two Memorials in the following words :—

To the Epping Forest Committee.

I.—Your Memorialists have heard with grave concern that your Committee have been urged to put a stop to all further removals of trees in Epping Forest for a period of years. The undersigned have examined the area in question, and are of opinion that such a resolution, if sanctioned by your Committee, would be productive of undoubted injury to the Forest, especially as regards those portions of Loughton, Epping, Waltham and Sewardstone Manors which are covered with a dense growth of pollarded trees.

Those who have approached you with the request to which we have referred do not appear to have apprehended the altered conditions which were brought about by the arrest of pollarding enacted in 1878.

Many of these pollards, whether single trees or groups, are capable of picturesque development, but only under healthy conditions and with adequate space. To leave them all to grow together—several hundreds to the acre—will lead to mutual destruction, while the continuous shade overhead destroys the undergrowth and the varied vegetation which constitutes the chief charm of a forest, and the hope of its reproduction in the future.

The evils we have indicated are already sufficiently manifest, and it must be obvious to all competent observers that, unless timely steps are taken, a few years' further growth must produce a singularly monotonous, artificial, and unhealthy result.

Some of us have been familiar with the Forest for many years, and can certify to the great improvement and the increase of natural growth which has already resulted from the operations of your Committee, now continued for many years.

To the Epping Forest Committee.

II.—We, the undersigned, being residents in Forest Parishes, beg to state that we have witnessed with satisfaction a great improvement in the aspect of the Forest, directly due to the removal, during the past sixteen years, of inferior stems, and to the consequent advance in beauty of those that remain, as well as the encouragement of healthy young growth. We are certain that it will be an irreparable misfortune if the careful thinning which has been hitherto carried out is not steadily continued.

We further beg to assure the Committee that, in our opinion, the operations in Hawk Wood, so far from being excessive, still fall short of what is required for the healthy growth of oak trees.

In Monk Wood there is already a marked improvement, following on your removal, eighteen months ago, of a proportion of the poorest pollarded trees. The same is true, even in a more marked degree, of Lord's Bushes. We believe that, if the gentlemen who have appeared as critics of your management were to judge of it by the appearance of the portions thinned three or four years after thinning, instead of immediately after, when they necessarily have a bare and unattractive effect, they would themselves be of a different opinion.

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[2] Mr. Robinson has since expressed his willingness to comply.

In conclusion, we beg to assure you that the view that the action of the Committee has been destructive is not entertained by those living on the spot, who are most qualified to judge.

The first of the above Memorials was signed by a number of noblemen and gentlemen, including the following :—

The Right Hon. Lord Rayleigh (Lord-Lieutenant of Essex), the Right Hon. the Earl of Gainsborough, the Right Hon. Viscount Powerscourt, K.P., the Right Hon. Lord Northbourne, the Right Hon. Lord Walsingham, F.R.S., the Right Hon. Sir John Lubbock, Bart., F.R.S., M.P., the Right Hon. James Bryce, M.P., the Honourable Mr. Justice Wills, the Right Hon. Geo. Shaw Lefevre, M.P., Colonel Lockwood, M.P., Professor J. B. Farmer, Sir W. H. Flower, K.C.B., F.R.S , Professor W. R. Fisher, J. E. Harting, Esquire, F.L.S., Walter F. Forbes, Esquire (Agent to the Duke of Richmond and Gordon), Professor E. B. Poulton, F.R.S., Mr. Briton Riviere, R.A., Dr. Masters (Editor of the "Gardener's Chronicle"), David Howard, Esquire (President of the Essex Field Club), T. V. Holmes, Esquire, F.G.S., M. C. Cooke, Esquire, M.A., LL.D., F. Kemble, Esquire, J.P. (Chairman of Essex Quarter Sessions), A. Savill, Esquire, of Chigwell, William White, Esquire (Curator of the Ruskin Museum, Sheffield) ; and also the Members of the Deputation whose names are specified above.

The second Memorial was signed by forty-four influential residents in the Forest Parishes, many of whom have been intimately acquainted with the Forest for a very long period of time, extending over sixty years.

Professor Meldola also read to us many letters he had received from the signatories to the first Memorial, and from other persons competent to express an opinion, commending the work of the Conservators.

It will be obvious to your Honourable Court that a considerable divergence of opinion exists upon the subject, and that if the action of your Committee were judged alone by the weight of authority attaching to those who have expressed themselves to be so entirely in accord with the past management of the Forest, a complete answer to the charges has already been made ; but we prefer to await and present to your Honourable Court the Report of the eminent Experts in Forestry whom we consulted last year, and by whose opinion and decision we are perfectly prepared to be judged and bound.

All which we submit to the judgment of this Honourable Court. Dated this thirteenth day of June 1895.

[Signed.] R. C. Halse, Oliver Henry Davis, Francis McCarthy, James Salmon, Richard Adam Ellis, Graham King, Reginald Hanson, E. North Buxton, J. Snowden, P. Gellatly, Frederick Cox.

Appended to this Report were statements and correspondence called forth by an article in the "Daily Chronicle" of May 4th, 1895 illustrated by pictures professing to be copies of actual photographs of spots where thinning had taken place; and the appendix also contained photographs of the same spots for comparison. These compared pictures may be seen in the Forest Museum at Chingford, the Epping Forest Committee having presented a set for exhibition there.

Subsequently, on May 14th, 1895, the following Report from the Epping Forest Committee was presented to the Corporation, to which was appended the final Report of the Experts. We can only hope that this Report will put an end to an agitation which has been most distasteful to many friends of the Forest. We will make no comments. A perusal of the very interesting documents we place now on permanent record, or, better still, a personal visit to the spots named, will be sufficient, we think, to convince any impartial observer that the Conservators have only done their duty in endeavouring to restore Epping Forest to a state of naturalness and vigour for the benefit of future generations of visitors :—

To the Right Honourable the Lord Mayor, Aldermen, and Commons of the City of London, in Common Council assembled.

WE whose names are hereunto subscribed, of the Epping Forest Committee, to whom on the second day of May last it was referred to make a special Report to your Honourable Court with respect to the charges of undue and unnecessary cutting of timber in the Forest, have the honour to certify that, on the 13th day of June last, we presented a Report to your Honourable Court, in which we set out the proceedings which had taken place on our being attended by various deputations on the subject.

We also reported that we had asked the five gentlemen who acted as Experts and reported to us last year, to visit the Forest again, and report how far the thinning which took place during last winter was carried out in accordance with their recommendations, and that Mr. Solicitor had been in communication with those gentlemen, but it had unfortunately been found impossible to arrange a meeting earlier than the middle of July last.

On the 18th day of July last, four of the Experts, viz., Mr. Anderson, Mr. Robinson, Dr. Schlich, and Mr. Webster, visited the Forest, and examined the work previously reported upon. Mr. Freeman-Mitford, C.B., was unable to attend, and the matter stood over until the 31st ultimo, when Mr. Freeman-Mitford, accompanied by Mr. Anderson, Dr. Schlich, and Mr. Webster, again visited the Forest. Mr. Robinson considered a further visit on his part unnecessary.

On the 1st instant, all the Experts met and drew up their further Report, a copy of which it is now our pleasure to annex for the information of your Honourable Court, and which will be found to be a further vindication of your Committee's action and policy.

All which we submit to the judgment of this Honourable Court. Dated the eleventh day of November, 1895.

[Signed.] R. C. Halse, James Salmon, Oliver Henry Davis, F. McCarthy, Frederick Cox, S. Elliott Atkins, J. Snowden, Richard Adam Ellis, P. Gellatly, E. N. Buxton.

[COPY.]

To the Chairman of the Epping Forest Committee.

November 1st, 1895.

SIR,—We have, again, very carefully inspected those portions of Epping Forest upon which we had previously reported, and we have examined the work which has been carried out since the issue of that Report, with the view of seeing whether it was in accordance with the spirit of our recommendations.

We beg to make the following remarks :—

Epping Thicks.—This was the first point visited. We were struck with the beauty of the outline which has been obtained by judicious cuttings on the fringe of the Wood. We consider that the work done throughout this Wood has been good.

Thames Valley (Theydon Bois).—This is an unsightly and monotonous portion of the Forest, owing to the number of gaunt Pollard Hornbeams. We consider that this would admit of further clearing, and that portions might be advantageously thinned out in large patches and sown with Oak, Beech, and other trees. As these grow up, further areas might be taken in hand in the same manner.

Theydon Coppice.—We have made one or two suggestions here to the Superintendent of the Forest with the view of opening out Glades. There are a number of young trees coming up through the Coppice which are in danger of being choked. These should be carefully preserved by cutting out such portions of the Coppice as are a source of danger to them. This course will enable this portion of the Forest to assume once more that natural aspect which the treatment of former years, when pollarding and coppicing were allowed, has obliterated.

Back of Riggs' Retreat (Theydon Bois).—The thinning here has been moderate. We have pointed out to the Superintendent places where further action is necessary, with a view to improving the condition of some of the finer trees.

Theydon High Wood.—In the Northern portion of this Wood, which consists of Beech trees, there is—as a matter of consequence—no underwood.

We consider that the policy to pursue in this portion is to mark those trees which are most worthy of preservation, and gradually to free them from any worse trees which may be injuring them. By laying down a definite line of action in this way there will be continuity of policy independent of changes of officials.

The Southern portion of the Wood may, we consider, be left alone for some years to come.

Broadstrood (Loughton)—We have made some suggestions with a view to improving the outline.

Woodridden Hill.—We have no objection to offer to what has been done here.

Verderers' Ride (High Beech to Woodridden).—We are of opinion that the glades which have been opened out here might have been bolder and less close together.

We have made some suggestions to the Superintendent with a view to improving these.

Clay Road, Loughton.—We consider that the breaking up of the straight line has been judiciously effected, and that the result is a great improvement on the previous state of things. The thinning has, nowhere, been excessive.

Bury, or Hawk Wood.—There are a number of Pollard Hornbeams in this Wood which should be removed. They are damaging the Oak trees; they prevent the boles of the Oaks from being seen, and their removal would improve the character of the Wood. We attach great importance to retaining the character of this portion of the Forest as an Oak Wood, and we would recommend that nothing further be done here beyond the gradual clearing out of the Pollard Hornbeams.

Bush Wood, Wanstead.—The thinning done here during past years appears to be judicious.

Wanstead Park.—The old Elms, with undergrowth of young Scyamore coming up between them, are the principal feature of this Wood. The object of thinning was to remove some stag-headed Elms, and those which interfered with the development of the Sycamores. No other Elms, unless dead or dying, need be removed; as the Sycamore now has sufficient light and air to hold its own against the Elm.

Walthamstow Wood.—In this Wood a number of Hornbeam Pollards have been cut out, in single trees, here and there. In our judgment, a better effect would be obtained, in future, by removing such Pollards as it may be desirable to get rid of, in groups, leaving other portions unthinned in the meantime. By adopting this course, a gradual return to a more natural condition of the Woodland would be obtained, the artificial Pollards giving way to natural and unmutilated trees.

Oak Hill, Woodford.—The thinning here has been carefully carried out.

Kate's Cellar, Loughton.—This Wood is typical of the large area of monotonous Hornbeam Pollards which are, unfortunately, so conspicuous a feature of Epping Forest. The clearings are too small, and too near each other. We recommend that, in future, they should be of a bolder type, and further apart.

Although it may not be exactly within the terms of our Reference, we beg to offer the following remarks for the consideration of your Committee:—

1. We would suggest that a plan of operations shonld be drawn up, showing which areas it is proposed to deal with during the next ten years, and the character of the operations. This Scheme should be drawn up by the Superintendent of the Forest, and submitted to the Epping Forest Committee, who might, if they thought well, take further advice as to the proposals made in the Scheme.

2. It is desirable that when the plan is matured and approved, the execution of the work should be placed in the hands of the Superintendent of the Forest, who should be responsible to the Committee for the entire management of the Forest.

3. At the present moment, the Forest is in places littered with heaps of cut timber. This is very unsightly, and we strongly recommend that arrangements should be made for the cut timber to be removed by the 1st of May in each year.

[Signed.] A. B. Freeman-Mitford, James Anderson, William Robinson, W. Schlich, A. D. Webster.

NOTE ON AN ADDER (*VIPERA BERUS*) TAKEN IN EPPING FOREST.

By G. A. BOULENGER, F.R.S.,

[*Read June 15th, 1895*].

[Although Adders are fairly common in the district, and have frequently been taken by members of the Club and others, but few forest specimens have ever been recorded in natural-history journals, and the few records hitherto made have given no precise details of measurement or description. The following brief note by the leading herpetologist in England will therefore be welcomed as a contribution towards our Forest Fauna.—Ed.]

A FINE male Adder or Viper was captured on the 12th of May, 1895, between the "Wake Arms" and Ambresbury Banks, by Dr. Lewis N. Jekyl, who kindly sent it to me for the British Museum.

In a paper published in "The Zoologist" for March, 1892, I have dealt with the variations of this snake in Great Britain, and made an appeal for further specimens in order to carry on my statistics. I have, therefore, much pleasure in reporting on the specimen found by Dr. Jekyl.

The specimen, which measures 22½ ins., in which the tail enters for 3, is typical in its lepidosis but for the presence of a single small shield (apical shield) instead of two, behind the rostral shield. It has eight upper labials on one side, and nine on the other; on both sides, the fourth and fifth are situated below the eye. The ventrals number 139, and the subcaudals 36 pairs. The ground colour above is a pale grey, with the zigzag and other markings of a deep black; below, uniform bluish black.

THE ESSEX FIELD CLUB.

MEETING AT THE BRITISH MUSEUM OF NATURAL HISTORY,

SATURDAY, APRIL 6TH, 1895.

ON the above afternoon the members of the Club were kindly invited by the Director, Sir William Flower, K.C.B., F.R.S., to inspect the magnificent Introductory or "Index Collections" at the Museum (which are approaching completion), and the series of native species of Mammalia, Birds, and Invertebrata now arranged in the British Saloon.

A large number of members and friends assembled at 3 o'clock in the Committee Room, when Sir W. Flower delivered a most interesting address on the nature and objects of the Index Collection, and the right way to see and study scientific Museums. In his remarks Sir William singled out for detailed description and demonstration a few typical collections, such as the case illustrating the varieties of the Domestic Pigeon; the case showing the variation of plumage, etc. in the two sexes in Birds, instancing the male Ruff (*Machetes pugnax*) and the female, the Reeve, belonging to the Snipe family. He also referred, among many other topics, to the examples of Protective Resemblance and Mimicry, and to the phenomena of Melanism and Albinoism, and to the case containing the two forms of Crows, which apparently are quite distinct, and which, judged by their external characters, might be held to be different species, but which may interbreed and produce offspring of a perfectly intermediate character; or which, as some naturalists believe, are examples of Dimorphism or the occurrence of a single species in nature under two different forms.

The Director then drew attention to the many beautiful collections contained in the bays or alcoves round the Great Hall, in which are contained the Introductory or Elementary Morphological Collections, designed to teach, by the exhibition of carefully prepared examples, dissections and drawings, the most important points in the structure of the principal types of animal and plant life, and the terms and characters used by naturalists in describing families, genera and species, and distinguishing one form from another. He particularly referred to the very striking case containing the "Horse and his Rider," being skeletons of a man and horse so arranged that they could be compared, and the position of the bones noted in relation to the external surface. Sir William also called attention to the case illustrating the morphology of the Amphibia, as one of the most beautiful and perfect examples of Museum exposition within his knowledge, extending as the latter did to all the principal museums in Europe. Other collections were referred to, and the immense time and patience necessary to carry out such work was hinted at.

At the conclusion of his valuable and most suggestive address, Sir William Flower accompanied the party on a tour of inspection of the cases in the Great Hall, and gave some most instructive demonstrations on the spot. The members present expressed their hearty thanks for his kindness and willingness to impart information. One case, which we understand is the exclusive work of Sir William himself, attracted great notice. It contains a series of Birds' Eggs, arranged so as to show the variation of form, surface, colour, etc., etc., of the different species, and it is a most wonderful example of skill and knowledge in teaching important biological facts by means of comparatively familiar objects.

The party also inspected the series of specimens in the British Saloon. Some most interesting additions have recently been made, notably Lord Walsingham's magnificent collection of British Lepidoptera, exhibiting the caterpillars of most of the species; also the late Mr. Buckler's collection of Lepidoptera, and the fine series of British Birds' Eggs contained in two large cabinets. The collections in this room show a marked improvement in mode of display and arrangement, and should now be of the greatest value to young students of out-door natural history in identifying specimens, etc., and gaining a correct idea of the species inhabiting our country.

During the afternoon, Dr. Henry Woodward, F.R.S., the keeper of the Geological Department, very kindly conducted part of the company to the geological galleries, for the purpose of demonstrating and explaining the cast of the complete skeleton of a gigantic *Iguanodon*, which is now one of the greatest ornaments in the Fossil Reptilian Gallery.

A FOREST RAMBLE, AND SECOND INSPECTION OF THE FOREST BY THE CLUB.
SATURDAY, MAY 18TH, 1895.

Conductors—Mr. E. N. BUXTON, *Vice-President* (*Verderer*), Prof. G. S. BOULGER, F.L.S., *Vice-President*, Prof. MELDOLA, F.R.S., *Vice-President*, and the *Secretaries*, Messrs. W. and B. G. COLE.

IN connection with this meeting, it was decided to combine the usual Spring Ramble through the Forest with an inspection of some portions of the woodlands which had recently been thinned by the Conservators, about which operations much newspaper controversy had again recently arisen, so as to permit members and their friends to form a judgment as to the true state of the case. Mr. Buxton kindly offered to act as principal "Conductor," and to point out precisely the nature and extent of the Conservators' work in those parts of the Forest in which the removal of the trees had been most criticised.

A very large and widely representative party of about 100 in number, including the Verderers, Chairman, and other members of the County Council, Col. Lockwood, M.P. for the Division, scientific men and experts in forestry and estate management, as well as the President, and most of the more prominent members of the Club, assembled at Chingford Station at a little after two o'clock, and quickly entered the numerous vehicles which had been provided to convey the party rapidly from point to point. The weather was somewhat ungenial, and consequently the Forest did not bear its best aspect, albeit many visitors new to the district expressed themselves charmed and delighted at the extent and beauty of the woodlands. Undoubtedly the two best times for viewing the Forest are spring and autumn, and the following words from Mr. Buxton's excellent little book "Epping Forest" were entered on the programme :—

> "Of the thousands of Londoners who refresh themselves by a visit to our groves, comparatively few do so at the two periods of the year when they are most beautiful—early May and late October [the period of our Fungus Meetings]. To the TREE LOVER *I strongly recommend the former month.* It is then, when the first burst of spring takes place, that the distinguishing characteristics, and especially the *colours* of each tree, can best be seen. A few weeks later the yellow of the young oak foliage, the grey green of the birches, and the burnished light-reflecting quality of the beeches, are merged in one uniform dark green, lovely in its varied shapes and play of light and deep shadow, but monotonous as to colour. The blackthorn in April, the hawthorn in May, a month later the crab, the sheets of the water-violet and water-ranunculus, supply the masses of white without which no group either of flowers or trees is complete."

The programme continued by directing the attention of naturalists and lovers of woodland scenery to the interest of much of the ground to be traversed, and specially referred to the many trees and woodland plants then in flower, and pointing out that "since light and air have been freely admitted, plants formerly uncommon are appearing in increased numbers and blossoming gaily. Two of our prettiest woodland insects—the Holly-blue butterfly (*Lycæna argiolus*) and the exquisite little moth, the Long-horned *Adela viridella*, are now common, the former flitting in the holly thickets, and the latter in companies rising and falling in small clouds over the early leafing branches of the oaks. On the outskirts of the woods we may hope to see the Orange-tipped Butterfly, one of our loveliest native insects, the 'Wood-lady' of the early Aurelians."

The first halt was called at Bury Wood (sometimes called Hawk Wood), mainly composed of spear oaks, hornbeam, and blackthorn. Mr. Buxton stated that the oaks were from eighty to 150 years' growth, and in that part of the wood which was thinned, which is about twenty acres in extent, there were approximately 2,000 standing,[1] besides a large number of hornbeam pollards. About 600 oaks were marked for removal, but on the recommendation of two of the Commissioners, nominated by their Chairman, 300 only were removed during the past season. On the one hand, there are those who urge that closely grown oaks have a beauty of their own, and that this wood should have been let alone ; on the other, it is pointed out that it has already entered upon a state of decadence, as is proved by the numerous dead and dying branches obviously caused by overcrowding, and by the poverty of the foliage.

Mr. Buxton and Mr. A. D. Webster took the greatest care to demonstrate and explain both what had been done and what remained to be done in this wood, and an impartial survey of its present condition would convince most people that some drastic measures must be taken if the wood is to be saved from decay consequent upon overcrowding. It was quite evident that the timber which had been removed and which had been placed for removal in one of the openings, was of a very poor description, and fit only for firewood, fencing-posts, and gate-posts.

The next part of the Forest examined was that by the straight, ugly path (known as the "Clay-ride"), made many years ago, when it was desired to convert the Forest into an "eligible building site." The party followed the path which skirts the Loughton Valley. The northern side of this valley was almost cleared many years ago, and attention was specially called to the natural growth which has supervened, and comparison invited with the pollard grove on the opposite side, which is typical of a large area of the Forest. At the eastern end of the "Clay-ride," Mr. Buxton explained that the clearances made during the past season had for their object the breaking up of the formal straight line, which marked the edge of the old enclosure, by cutting "bays" here and there. It was here that the criticism had been most directed, and it is perhaps an open question whether the monotony of the straight lines of the ride might not have been better improved away by a little judicious planting, rather than by making the bays. Striking northward, the Loughton or "Cowper's" Camp was skirted, and the sites of two recent fires were pointed out, and the young growth of birch and other trees beginning to appear was a matter of much interest in connection with the renewal of the Forest. The birch promises to be the predominant tree in all new clearances. This, as Mr. Buxton remarked, is not to be regretted. It is an "all the year round tree" of the greatest beauty, and it has the great merit of being able to survive the injury caused by forest fires better than almost any other tree.

Still rambling northward, a visit was made to Monk Wood, inspected by the Club in 1894 immediately after it had been thinned (see ESSEX NATURALIST, vol. viii., pp. 54-56), to allow of a judgment being formed of the effect of the operations after the lapse of a year. The self-sown beeches were numerously in evidence, and it is clear that, in many places at least, the Forest will renew itself, if light and air are admitted, and the devastations of the cattle are restrained.

Time would not allow of a visit to Honey Lane Quarters, a wood consisting mainly of hornbeam pollards, very closely ranked, and situated on the slopes of the hill overlooking the Lea Valley.

Tea was taken at the "King's Oak," after which A MEETING of the Club (the 156th) was held (the President in the chair) for the proposal of candidates for membership, and to hear from Mr. E. N. Buxton particulars of his scheme for the protection of certain birds in the Forest area. Mr. Buxton's remarks have already been printed in THE ESSEX NATURALIST (*ante*, pp. 49-50), and at the meeting his pleas for the formation of a protected area were very warmly seconded and emphasised by the President, Mr. D. Howard, and by Mr. F. Carruthers Gould, who incidentally remarked that in his opinion birds were increasing in the Forest, and mentioned that his son during a summer afternoon's ramble had noted, amongst many other species, the willow-wren, chiff-chaff, starling, chaffinch, bullfinch, yellow-hammer, redstart, wren, great-tit, blue-tit, marsh-tit, and jay.

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[1] The number of oaks varies from 50 to 160 per acre, and their diameter at three feet from the ground is from ten to fourteen inches in the great majority of cases.

Quitting the "King's Oak," the party was driven to near Ambresbury Banks, in order to allow of an inspection of Epping Thicks, one of the most beautiful sections of the Forest, and containing the finest timber, where one gets the prettiest peeps through the glades into the interior of the woods on either hand. Over a part of this area the undergrowth has almost disappeared, having been checked by the overgrowth. A considerable number of hornbeam pollards were removed during the season of 1894-5, but in parts of the woods it is quite manifest that more thinning must be done. Some parts thinned years ago, are now in a flourishing state, and are delightful object-lessons in woodcraft.

A pleasant drive back to Chingford and Loughton Stations, during which the nightingales were heard commonly, brought the meeting to a close.

Many excellent reports of this meeting appeared in the newspapers, and we may particularly mention those in the "Daily News," the "Gardener's Chronicle," "Nature," the "Essex County Chronicle," and the "Essex Times." As many people of position and influence were present at the meeting, the practical demonstration afforded was of great value, and it cannot be doubted that many were convinced of the soundness of the general plan of management now adopted by the Conservators. Differences of opinion on matters of detail will, of course, arise, and are salutary in attempts to find out the best methods, but we feel sure that very few who have known the woodlands from the time when they were intrusted by Act of Parliament to the care of the Corporation, will deny that great improvement is now manifested. The mistakes made were in the very early days, but since a scientific system of forestry has been in operation, most of the woods are yearly becoming more and more "natural" and luxuriant.

Attention is called to the Reports of the Experts, and other official statements printed in the last volume (ESSEX NATURALIST, vol. viii., pp. 117-121), and in the present volume, *ante* pp. 74-80.

FIELD MEETING IN ONGAR PARK WOODS AND 157TH ORDINARY MEETING.

SATURDAY, JUNE 15TH, 1895.

A VERY pleasant field excursion was made in the above district by the kind invitation of W. S. Chisenhale-Marsh, Esq., J.P.

A few of the members went down early in the morning, and spent the time until the arrival of the main party in botanising and observing the insects in these extensive woods. They were part of the Royal Forest of Essex, under the illegal afforestations of Richard and John, but in later times were thrown out of the Forest, and became one of the "Purlieus," for the history of which the reader is referred to Fisher's "Forest of Essex." The district had not been visited by the Club since July, 1884, in the report of which meeting (in "Journal of Proc. E.F.C.," vol. iv., pp. civ.-cviii.) is printed the late Mr. James English's account of the entomology of the woods. The reader will also find a sketch of the Botany of much of the ground in the report of a ramble from Epping to Theydon Garnon in August, 1881, in our "Proceedings," vol. ii., pp. xlii.-xlvi.

The weather was very pleasant, and many interesting flowers and insects were observed. The beautiful little *Adela degreerella* was plentiful in some of the rides, and on a rubbish heap near the house a large quantity of the Yellow Balsam (*Impatiens noli-me-tangere*) was noticed in full bloom. The route was through Ongar Park Wood, and through Gaynes Park Wood to Gaynes Park, where the party was most kindly received at tea by Mr. and Mrs. Chisenhale-Marsh.

Afterwards an adjournment was made to the library, where the 157th ORDINARY MEETING was held, Mr. David Howard, President, in the chair.

The minutes of the meeting on May 18th were read and confirmed.

On the motion of the President, a cordial vote of thanks was passed to Mr. and Mrs. Chisenhale-Marsh for their kind reception of the Club that afternoon.

The following were elected members of the Club:—Mrs. J. A. Finzi, Mr. Alfred G. Howard, F.L.S., Mr. D. Lloyd Howard, Dr. F. J. Smith, Mr. C. Hewlett Taylor, and Mr. E. W. Hawkins.

Mr. W. Cole exhibited a small ornament of gilt copper, of Roman age, one of two similar in character, found some years ago near High Beach, which had been presented to the Epping Forest Museum by Sir John Evans, F.R.S., late President of the Society of Antiquaries, and one of the honorary members of the Club.

Mr. Cole also exhibited a collection of the two snakes occurring in the Forest (the Grass or Green Snake, and the Adder), as well as the snake-like lizard, the Slow-worm (*Anguis fragilis*). In the collection was included the specimen of the dark form of the Adder ("var. δ" of Jenyns, "Man. Brit. Vert. Animals," p. 298), which had been found at Loughton in 1883, and which he had already recorded in the "Journal of Proceedings," vol. iv., p. x.). This dark form appeared to be rare, and he had never met with another specimen.[1]

Mr. Walter Crouch exhibited a handsome living specimen of the Ringed Snake, which had been lent to him for that purpose by Mr. Wykeham Chancellor. This snake, nearly 3 feet in length, and with a very well defined neck-collar of a bright yellow colour, was handed round, and became a great favourite with all, even the ladies, who allowed the reptile to nestle in their laps, and coil around their hands.

Mr. Crouch also said that Mr. G. A. Boulenger, F.R.S., of the British Museum of Natural History, had kindly sent him, to read at this meeting, a note on a specimen of the Viper recently caught near the "Wake Arms" in Epping Forest (see note by Mr. Boulenger in the present part of the E. N.).

Mr. Crouch and Mr. Cole pointed out the distinctions between the Ringed Snake and the Viper, and gave some details as to their localities in the Forest.

Prof. G. S. Boulger, F.L.S., then gave a very interesting address on the subject of "Corn-field Weeds," in which he more especially discussed the probable foreign origin of many of the common plants of our corn-fields.

Considerable discussion ensued, in which the President, Prof. McConnell, Dr. Smith, Mr. W. Cole, Mr. Crouch, and Prof. Boulger took part.

Votes of thanks to the authors of the papers concluded the meeting, and the members afterwards rambled through the woods back to North Weald Station.

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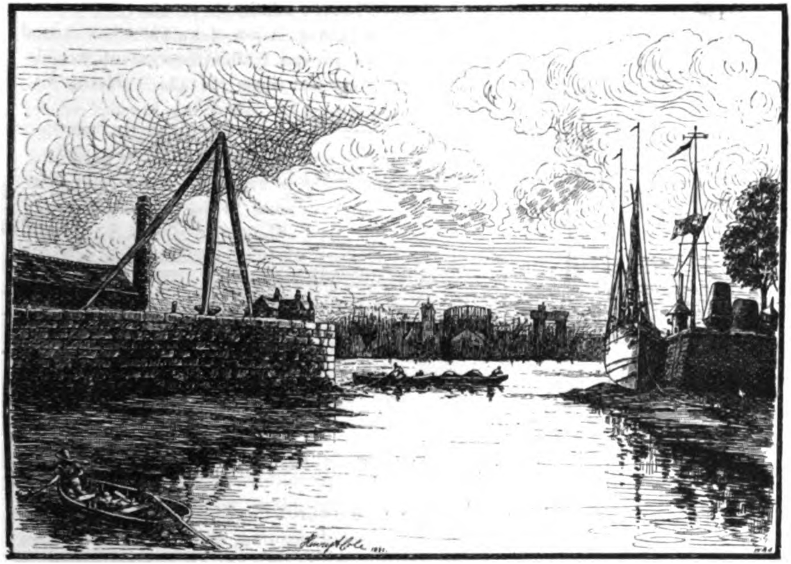
[1] I have placed this specimen in the Forest Museum at Chingford.—W.C.

THE RIVER LEA: VOYAGE FROM BROMLEY TO WALTHAM ABBEY, SATURDAY, JUNE 29TH, 1895.

Conductors—Major LAMOROCK FLOWER, F.S.I., F.R. Met. S. (*Sanitary Engineer, Lee Conservancy Board*); Mr. WALTER CROUCH, F.Z.S.; Colonel BRYAN (*Engineer to the East London Waterworks Company*); and Mr. W. COLE, *Hon. Secretary.*

THE Lee Conservancy Board having again kindly lent their steam barge, "The Salisbury," to the Club, it was decided on this day to complete the tour of the River Lea, commenced last year (14th July, 1894), when the journey was begun above the water companies' intakes, down stream from Hertford (see full report in ESSEX NATURALIST, vol. viii., pp. 205-213; and papers on "Izaak Walton's Association with the River Lea," by Mr. Harting, vol. viii., pp. 186-198; and the "Geology of the Lea Valley," by Mr. T. V. Holmes, vol. viii., pp. 198-201). On the present occasion, it was determined to commence at the lower end of the river, and work up stream to Waltham, a distance of about fourteen miles.[1]



MOUTH OF THE LEA, AT BLACKWALL.
(*Drawn August*, 1890.)

As last year, the pictures which adorned the very handsome quarto programme of the meeting were drawn from nature at the spots named, by Mr. H. A. Cole, and presented by him to the Club.

The "Salisbury" was moored at Bromley Locks, close to the head of Limehouse Cut, by which the River Lea passes into the Thames at Blackwall. The start was made at ten o'clock, on a beautifully fine summer morning, and those on board soon had an opportunity of appreciating the great commercial importance of the Lea as a waterway, as demonstrated by the crowded state of the stream. At Bow Bridge, the President, Mr. Howard, F.C.S., and Mrs. Howard, came on board, accompanied by Mr. Andrew Johnston (*Chairman of the Essex County Council, and member of the Lee Conservancy*); and the company included Mr. S. W. Squier, J.P., Mr. W. B. Whittingham, J.P., Mr. T. V. Holmes, F.G.S., Mr. J. Spiller, F.C.S., Professor Almond, Mr. W. W. Duffield, Mr. H. S. Bartleet, Mr. and Mrs. S. Johnson, Mr. and Mrs. Porter, Mr. W. M. Webb, F.L.S., Mr. A. Double, C.C., Mr. Knott, Mr. H. A. Cole, Mr. B. G. Cole, the Misses Cole, Mr. G. E. Vaughan, Mr. Meggy, Mr. and Mrs. Borrow, and many others, including the conductors.

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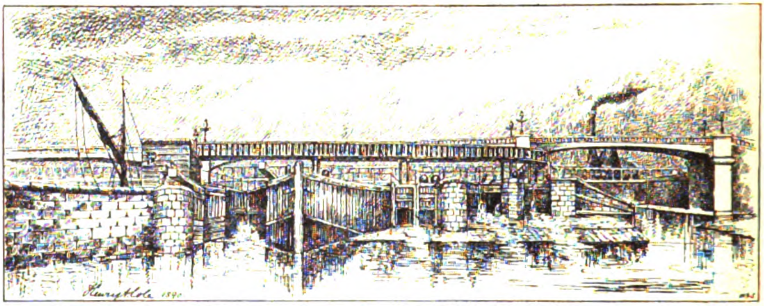
[1] We have always printed the word Lea with an "a" in our publications, as being probably the correct mode, but in all Acts of Parliament and printed documents of the *Lee* Conservancy it is printed thus. Public bodies seem to have an objection to the use of the first letter of the alphabet—the Epping Forest Committee will spell High Beach with the double e—ignoring the evidence of the old direction-posts and maps.—ED.

The River Lea (to quote from Major Flower's admirable summary) has been the subject of many Acts of Parliaments, the appropriation of its water has caused much litigation, and "Millers' rights" have proved fruitful sources of trouble, until very recent date. The two earliest Acts are those of 1424, 3 Henry VI., cap. 5; and 9 Henry VI., cap. 9. These empowered the Chancellor for the time being to issue commissions for the purpose of cleaning, scouring and amending the River *Ley*,—which in both of them is stated to be "*une des grandes rivers*" of England. In 1425 a petition was presented to Parliament, and answer granted, for a Commission of Conservancy—the first conservancy of a river in England. The present Board of Conservancy was established by "The Lee Conservancy Act, 1868"—31 & 32 Vic., cap. 154, supplanting the old Trustees, which body was established by 13 & 14 Vic., cap. 109, "The Lee Navigation Improvement Act, 1850," and of whom the late Lord Salisbury was Chairman. This was an important Act regulating water rights. These were still more clearly defined by the Act of 1855—18 & 19 Vic., cap. 196, "The River Lee Water Act, 1855." The general result of these provisions is, that a paramount right is given to the Trust for water acquired for the purposes of navigation; and that the remainder of the water is divided between the two water companies practically in equal shares. Annual payments are made by the water companies as follows:—From the New River Company, £1,500—this Company also contributed £42,000 to the Trust for construction of works on the navigation; the East London Waterworks Company pays £2,000 a year, and both companies pay a sum not exceeding £1,000 a



BROMLEY LOCKS, LOW TIDE. (AUGUST, 1890.)

year for the purpose of "Protection of Water," and for these payments the companies at the present time draw about 55,000,000 gallons of water daily.

By "The Lee Valley Drainage Act, 1892" (55 & 56 Vic., cap. 102) "The Lee Valley Drainage Commissioners" were appointed, with power to carry out certain works to prevent floods in the lower district.

The navigable portion of the Lea, partly along the natural river and partly in made channel, extends from the Town Mill Bridge in Hertford to the Thames, and is available for craft coming from the lower part of the river and the Medway through Bow Creek, and from the upper part of the Thames through the Limehouse Cut, and also from the junction of the River Stort, at Hoddesdon. The Stort is navigable up to Bishop's Stortford, a distance of 13 miles, with a total rise of 93ft. with fifteen locks. The length of the navigable Lee is 27¾ miles, with a total fall of 109ft., and nineteen locks intervening. These locks are calculated to admit barges of 90ft. in length to any point, and of the following widths: from Hertford to Enfield Lock and the Stort, 13ft. 3in. wide—from Enfield Lock to Ponder's End, 16ft. wide—thence to Old Ford, 18ft. wide, and from Old Ford to the Thames, 20ft wide. The draught of water above Enfield Lock is 4ft. 6in., and below that point it is 6ft.

Since 1850 the locks from Ponder's End to the Thames have all been renewed or reconstructed; they are of brick and stone. Above Enfield Lock are five new and wider ones, built of brick and stone, and eight old ones with brick upper and lower ends, and wooden sides.

Mr. Walter Crouch, being specially well acquainted with the district, kindly undertook the "conductorship" of the excursion up to Lea Bridge, and during the journey exhibited many plans, maps, and engravings of the course of the old river and the buildings which formerly stood near its banks. Mr. Crouch's expositions were given at intervals as each spot of interest was passed, but he has kindly thrown his notes together, and we print them as a continuous narrative for convenience of reference. A rumour floated about on board of a conspiracy of Major Flower and others relating to the issue by the Club, at some future time, of a more complete epitome of the history and topography of the lower Lea. Its history has never been written, and a paper on the subject, well illustrated, would be a welcome addition to the many topographical memoirs already published in our journal:

NOTES ON THE RIVER LEA. BROMLEY—BOW—OLD FORD.

By Walter Crouch.

A bit of good advice was given by the Marquess of Salisbury a few years ago, when he told politicians to "study large-scale maps." On board this vessel, which bears his name, I would repeat this advice to all who are wishful to understand the art and craft of the River Lea and its navigation.

In geological times the whole of this tract was a shallow sea, or gigantic estuary. Even a thousand years ago the Lea was of larger proportion than now; for in the days of King Alfred, the Danes took their ships up toward Hertford; and the Channelsea was probably the current the king then utilised, by means of a cut made to divert the waters, and so strand the Danish vessels.

In later times the tract was often flooded, as we know from monkish records, some notes of which I gave at our second West Ham meeting

(26th June, 1886), in connection with a notice of the Abbey of Stratford Langthorne. (See "Journal of Proceedings," Essex Field Club, vol. iv., pp. clxxxviii.—ix.)

[Mr. Cole pointed out that the flora of the marshes here was of an estuarine character, and several brackish-water shells could still be found in the rills or in the recent alluvium.]

The land around is very low. At Plaistow it is but 4 ft. above the Ordnance Datum; at the church in Stratford Road only 3 ft.; and at Lea Bridge 4 ft. The marshes on the N. side of Stamford Hill and Clapton are only 7 ft. above O.D. But the waters are now well in hand. On the Lea by Hackney Marshes there is often in summer not enough depth for a boat to pass along: and only last week this barge on which we now are could not be taken up to Limehouse for use of the Conservancy Board on their annual visit of inspection of the River.

Starting from Bromley Lock northward, we may note the sluices which cut off Bow Creek from the River Lea, and we leave on the west the Limehouse Cut, which passes along to the Thames near Regent's Canal Dock. On the right (east side) the continuation of Bow Creek (which joins the Thames near Canning Town and the Thames Iron Works), running north for a short distance parallel, and then breaking up into the streams called the Channelsea, with Abbey Creek, the Three-Mill-Wall, and the Three-Mill-Back, rivers; the Creek itself again joining the River Lea a little north of Three-Mill-Bridge.

The first bridge under which we pass belongs to a private road, leading to the works of the Gas Light and Coke Company; the next that of the London and Tilbury Railway—and we then come to Three-Mill-Bridge, on our way to Bow.

The Parish of Bromley St. Leonard's was mainly fields when I was young, and on the north side of Three-Mill Lane there was, until some thirty years ago, the remnant of a high and massive red brick wall with alcoves, a relic of the Priory of Bromley, a Benedictine nunnery, dedicated to St. Leonard and founded temp. William the Conqueror by the Bishop of London, for a Prioress and nine nuns. The Manor of Bromley was the endowment; and at the suppression it was valued at £108 1s. 11d. "The Chapel of St. Mary, within the convent of St. Leonard," now the parish church, is a small structure, showing remains of Norman work, and consisted of a nave and chancel; which was partly rebuilt, with additions, some years since. Within this church, Elizabeth, sister of Queen Philippa, and daughter of William, Earl of Hainhault, was buried in 1375. There are some fine old monuments with effigies, etc., in the Church—of the time of Elizabeth and James I.

There can be little doubt that Chaucer had the teaching given in this convent in his mind when he wrote in the "Canterbury Tales":

> "French she spoke, ful fayre and fetisly,
> After the schole of Stratforde atte Bowe,
> For French of Paris was to hire unknowe."

It is worth while to mention that Weever, in his "Ancient Funeral Monuments," 1631 (p. 541), is obviously in error when he states that a monastery of white monks existed here, and that John de Bohun was entombed in the abbey church. He has evidently confounded this with the Abbey of Stratford Langthorne, on the other (Essex) side of the Lea.

We now arrive at Bow Bridge; an interesting spot, as all authorities agree in the statement that here was the first stone bridge ever built in England, "a rare piece of worke, for before the time the like had never been seen in England." The site was called Stratford Ferry.

There can be little doubt that the old Roman road from London into Essex ran through Shoreditch, and we have good evidence that this road passed over the Lea at Old Ford, either as a ford or ferry.

At Oldeforde (to quote its olden form) a portion of the Roman road, which has always been known by that name, exists; and on land abutting on this road, close by and north of Coborn Road Station, when it was cut up for building about 1866, a stone Roman coffin containing a skeleton and pottery was unearthed. These were described by my old friend, Mr. H. W. King, the well-known antiquary, and I have a photograph of them taken *in situ*. Where the road then came out after crossing the marshes is not so clear, but in all probability it was close by the Channelsea Bridge at Stratford (straight-ford), or, maybe, a little north of that point. The crossing of the marshes was a difficult matter, for they have always been subject to floods after heavy rains; and we have historical data of the dangers often incurred, which will be quoted later. At the present time, there would be four streams to be crossed, but Mr. King asserted that none of these existed in the time of the Roman occupation. It is, at any rate, probable that these streams were subsequently cut, either to drain the marshes, or to form mill streams.

With regard to the course of the present road, the earliest evidence we have is in one of the Plea Rolls, which have been printed under the title of "Placitorum Abbreviato." In Roll 95 we find Middlesex and Essex:

"Our Lord Edward the Kings father in the 31st year of his reign (1302) commanded Roger de Brabazon and others that they should enquire who ought to repair the Bridges and chalk causeway in the Kings Street between Stratford atte Bowe and Hamme Stratford."

Concerning the deficiencies, an inquisition was made by a jury, twelve for Essex and twelve for Middlesex:

"They said the ferry over the water of Luye or Lee at Stratford-atte-Bowe was anciently accustomed to be at that place called Oldeforde, which is one league distant from the place of both bridges and the causeway, and now are near together; at which ferry many, crossing over from various places, have been plunged in the water and in danger. And when afterwards such great danger came to be made known to the Lady Matilda the Queen of England, Consort of our Lord Henry the Ist King of England, [she was Abbess of Barking Abbey, and must often have passed along this route], she, moved by her piety, commanded it to be examined how both the bridges and the causeway could be made better and more convenient for the utility and easement of the country and the passengers over them. The which was done by the said Queen, who also caused two bridges to be built – namely the bridge over the water of Lee, and the upper end of the towne of Stratford-atte-Bowe; and another bridge over another trench of the same water, towards Essex, which is called Channelesbrigge. And also, a chalk causeway between the said bridges, so that all passengers going over it may well and securely cross the same. And forasmuch as the said queen desired that the reparation and support of the aforesaid bridges and Chalk Causeway should from that time be imposed, so, out of her charity, she bought those lands, rents, meadows, and one water mill which is called Wiggemulne, and assigned them to be for the repair and support of the Bridges and Chalk Causeway aforesaid."

This duty was imposed upon the Abbess of Barking and her successors, as the Abbey of Stratford was not founded by Gilbert De Mountfitchet until 1135. Later, however, an Abbot of the latter bought the lands of this trust with its obligations; then, as repairs were needed, constant disputes arose and continued till 1315, when an agreement was made between the then Abbot and Abbess before the Chancellor of England and the Chief Justice on behalf of the King, and it was enrolled that the said Abbot obliged himself to repair the Bridge for ever, for which the Abbess gave him £200, yet saving to her the annual four marks.

From the Patent Rolls we find that one Hugh Pratt, living near the said Bridges and Causeway in the reign of King John, did, of his own authority, begging the aid of passengers, keep them in repair, and, after, his son William did the same, until the King's Justice obtained a toll for him; and so the repairs were made till Philip Bassett and the Abbot of Waltham, being hindered from passing that way, broke down the iron railings and left it in ruins, till Queen Eleanor, of her bounty, ordered it to be repaired, counting the charge of it to William de Capella, keeper of her chapel. (There was a chapel on the Bridge dedicated to St. Catherine.) The question of repairs to the Bridges and Causeway has been a question of dispute from that time even into the present century, and the lawsuits in connection almost numberless.

In 1366 a toll was granted for the repair of Stratford Bridge, to continue three years, it being very ruinous.

These particulars (a mere summary) are authentic; and such description as is given by Leland (temp. Hen. VIII.) is accurate, and bears out his general trustworthiness. Stow, in his "Annals," gives an account which is manifestly inaccurate, and not in accord with the Rolls, to which he probably had not access, and, perhaps, knew not of their existence.

The original Bow Bridge consisted, in all probability, of seven arches; although but three were apparent in this century, the others being hidden in the cellars and foundations of the adjoining houses, and mostly bricked up. Two of these arches on the Essex side were discovered over one hundred years ago.

Some years ago I had access to a report, dated 5th January, 1828, in private hands, concerning this Bridge, of which I made a copy, from which I will give a few notes:

Mr. Walker, in 1827, was asked to report upon Bow Bridge. He was of opinion that the original Bridge formed no part of it, unless some of the foundations were original, as they were well below water-mark. Coffer dams were not then known, and the course of the River was probably on the east side of the present channel, so that the Bridge was built upon the only land on the Middlesex side, and the river course subsequently turned under it by excavating a new channel and filling up the old one—the sudden turn of the river appearing to support this conjecture.

The extreme width of the Bridge was originally only 18 feet 3 inches, and to increase this that pieces had been erected on the cut-water of the piers which added to the width five feet on the Middlesex side and seven feet on the Essex side. The arches for these additions were circular, and higher than the old arches. The spans were 20 feet 3 inches, 22 feet 10 inches, and 20 feet 3 inches respectively; total, 63 feet 4 inches.

The great flood of the year 1824 brought the water within two feet from the centre of the mid-arch. The only *footway* was a wooden platform, seven feet wide, resting on the pier end on the *North* side. The idea at that time was to enlarge the Old Bridge, but Mr. Walker's report was in favour of an entirely new Bridge.

No action, however, was taken for some years—until about 1835, when a temporary bridge was erected; and the present handsome structure of granite, consisting of one segmental arch of fine proportion, was built by Sir John Rennie 1837-39, at a cost of £12,000.

To build the approach to this new bridge, an old roadside inn called the "Bombay Grab," which stood at the S.W. corner (in Middlesex), had to be pulled down. It abutted on the river, whose waters washed its side walls (as at the inn at Waltham). In 1860 I noted that the site was occupied by a slate merchant, opposite Abbott's brewery (now Smith, Garrett & Co.).

In 1858 two of the bridges were kept in repair by the Bridge House of London, and the ancient estate at Stratford, charged with these repairs, produced a rent of £409 4s. od. per annum.

No doubt when the bridge had been made, and the traffic thereby increased, a cluster of houses and inns soon gathered around the improved means of communication; and the Parish Church of Stepney being over two miles away, a new church was soon required. Lysons tells us "that the Church of St. Mary, Stratford-le-Bow, was founded by King Edward III. on a piece of ground which formed part of the king's highway"; but Newcourt places it earlier, saying: "that on account of the distance from Stepney, the Bishop of London granted a license in 1311 to erect a chapel there. The present church, however, standing in the middle of the road, shows no evidence of an earlier date than 1480. It consists of a nave, with two aisles and chancel, and a west tower. It contains a number of monuments; the most notable being that of Mrs. Prisca Coburne, who was a liberal benefactor in lands and money to the parishes of Bow and Stepney, the founder of the Coborn Schools, and died in 1701. She was the daughter of one of the ministers of Bow, and widow of a brewer. Another monument is in memory of their daughter Alice, who died in 1689, at the age of sixteen. This contains a marble bust, with a lengthy inscription in Latin, with Greek and Hebrew, written by her lover, Mr. Wollaston. The Registers begin 1538.

This church was nearly surrounded by houses—one, an old market-place supported on pillars, with a justice-room above; and among the old views I have brought with me to-day, there is a very pretty engraving by George Cooke, from a drawing by A. W. Calcott, R.A., which gives a good idea of the place in 1826. It was sketched just in time, for about 1830 the old houses were taken down, the iron frame of the fire-beacon removed from the church tower, and the top story cased with new stone, with an embattled parapet. The present condition is well depicted in the water-colour drawing taken for me in 1863 by E. S. Chatterton.

Mr. Walter Besant thus mentions it in his novel, "All Sorts and Conditions of Men": "There is not much in the Bow Road except the beautiful old church, standing in the middle of the road, crumbling slowly away in the East End fog, with its narrow strip of crowded churchyard. One hopes that before it has *quite* crumbled away, someone will go and make a picture of it—an etching would be best."

Bow was created a separate Parish in 1711, and the Rectory House, where I have spent many a pleasant day with a former Rector, was built about 1720-30.

By the time of Queen Elizabeth, Bow had grown into a large village. Some fine houses of her reign were removed in my early days, and I have some carved oak trusses from one of them. Fox, in his "Book of Martyrs," says that Stratford-the-Bow was the scene of the burning of one person for heresy, in the reign of Mary, but he may have confused this place with Stratford proper.

This village was then a pleasant excursion from London in the summer days. Will Kemp (a comedian in the same company as Shakspeare), in his Morris Dance from London to Norwich, "Kemp's nine daies wonder," thus mentions Bow :—

> "But eyther to keepe a custom which many holde, that Mile End is no walke without a recreation at Stratford Bow with creame and cakes, or else for love they beare toward me . . . however many a thousand brought me to Bow, where I rested awhile from dancing, but had small rest with those that would have urg'd me to drinking. . . . The Tabrer strikes alarum. Tickle it, good Tom, I'll follow thee. Farewell Bowe, have over the bridge where I heard say honest conscience was once drown'd . . . let's now away to Stratford Langton."

Among the many reminiscences of Bow, stands the famous Bow Fair—a wild carnival held on Whitsun Thursday, in the Fair-fields, now but a name in connection with the road so called. Then on Easter Monday the famous Cockney Hunt in Epping Forest was a feature, a subject which has been so humorously treated by Tom Hood, a halt being called here for the entertainment of man and beast.

Old Samuel Pepys was often here, sometimes for an airing, or to dine with Lady Pooly, or breakfasting here on eggs on his way to Waltham Forest, "where we saw many trees of the King's a-hewing."

Another gay time was the first Friday in July, on the occasion of Fairlop Fair, when the procession of watermen's boats passed, and halted on their journey to Hainhault Forest.

A large amount of washing was done here in the last century, and a short account in 1761 notes that "this village is inhabited by many whitsters and scarlet dyers," a whitster being a laundress. "Carry it among the whitsters in Datchet mead."—*Merry Wives of Windsor.*

About this time, or rather earlier,[2] the celebrated Bow China Works were established, the precursor of the better known Chelsea. The exact spot, however, was unknown until 1868, when a large quantity of patterns, broken pieces, etc., were found on the Essex side, when some alterations were in progress at the works of Bell and Black, now Hogarth's pickle-and-jam factory.

In 1770 the bodies of two notable highwaymen—Conway and Richardson—after execution at Tyburn, were hung in chains on Bow Common, and over 40,000 people went to view the sight in the first week.

At Old Ford, in the track of the Old Roman Road, but close to the river, there existed, until some thirty years ago, an ancient gateway of brick, with stone mouldings and carved corbel heads, which marked the position of a fine mansion which formerly stood there, called "Old Place." It was standing in the reign of Queen Elizabeth, but was pulled down before 1665, when the site was presented to Christ's Hospital. In Bearbinder Lane, between the Roman Road and the main road, a quiet, shady lane surrounded by fields, when I was a boy, I first saw mistletoe growing on one of the tall elm trees.

Just beyond Bow Bridge, on the Essex side, is a side branch of the Lea which splits up into the Pudding Mill river, the City Mill river, and through the Mill Pool to the Waterworks river. These three rivers again join the Lea close by

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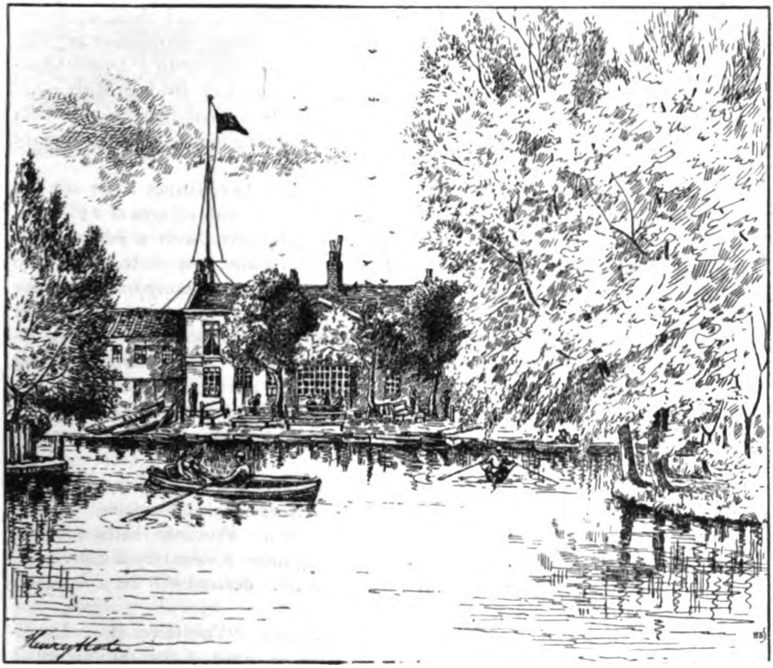
[2] In the account quoted in the last paragraph, 1761, we find, "Here has lately been set up a large manufactory of porcelain, which is brought to such perfection as to be very little inferior to that of China."

Hackney Marshes, and the Channelsea also, farther north, meets the Lea at Temple Mill Bridge.

Passing along by Old Ford under the Great Eastern Railway, on the right we notice the Midland Goods Station, formerly the East London Waterworks Reservoir; then under the northern main drainage[3] until we arrive at Old Ford Lock, where we leave the old river which flows round to the eastward, and passing through the lock we rise nine feet, and proceed up the Hackney Cut of the Lee Navigation, where a considerable improvement in the condition of the water is observable.



THE OLD BOATING HOUSE AT LEA BRIDGE, THE "JOLLY ANGLERS."

A little way beyond, on the western side, is the entrance to Sir George Duckett's canal, which was made to connect the Lea with the canal system to Birmingham and the northern canals, and is still largely used. Further along we pass under Whitepost Bridge, and Wick Bridge, with Hackney Marshes on the eastern side, and a view of Old Leyton, with the higher forest land of Essex. Almost adjoining is the site of the compensation Reservoir which it is proposed shall be acquired by the London County Council and converted into a People's Park; whilst on the western side lie Victoria Park, Hackney, and Homerton, and passing under Marsh Gate Bridge, Brick Lock Bridge, Pond Lane Bridge, and Waterworks Bridge, we come to Tumbling Bay and Lea Bridge, and the depôt of the East London Waterworks Company.

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[3] The crossing of the sewer was selected and sanctioned by Parliament for the storm water outlet of the main drainage, which was laid without due appreciation of the vastness of the volume of sewage which flows along. In times of heavy rainfall serious overflow occurs, and much fouling of the Bow river results. It is hoped, however, that the improved conditions now in progress may lessen the evil.

Thus far Mr. Crouch, and here at Lea Bridge a landing was made, and Colonel Bryan conducted the party over the works, fully explaining the astonishing array of powerful pumping engines, eight in number, and distributing a printed memorandum giving details of the construction and capabilities of work of each of these. There are also several turbines for pumping water, and which are actuated by the fall of the River Lea.

The East London Water Company commenced in 1807 and 1808, when the proprietors became possessors of the Shadwell Water Works, established in 1669, and the West Ham Water Works, which originated in 1747. In 1829 the Company purchased the Hackney Water Works and the Lea Bridge Mills, and obtained an Act in the same year, under which they removed their intake from Old Ford to Lea Bridge, the works at Old Ford being finally abandoned early in 1892.

In 1852-1853 they obtained an Act enabling them to construct large settling reservoirs at Walthamstow. These are eight in number, with an area of 236 acres, and filter beds at Lea Bridge, of which there are twenty-five, with a joint area of twenty-four acres; also to make the intercepting drain west of the Lea from Ponder's End to Tottenham Lock, to intercept all sewage likely to pollute the water above their intake. In 1867 an Act was obtained for increasing the number of reservoirs at Walthamstow and filters at Lea Bridge. In 1886 the Company obtained an Act for diverting certain portions of the River Lea and also the Ching Brook, a small tributary which joined the old Lea above the intake, but the diversion of the Ching prevents any pollution reaching it. In 1883 Chingford Mill was acquired by this Company, and a well and borehole sunk into the chalk 450 feet below the surface.

This Company is also extending its operations by sinking wells and driving galleries in the chalk in various directions. Exceptional difficulties, Colonel Bryan said, were encountered in sinking the cylinders. From the surface of the ground to the chalk was entirely quicksand. The water is raised by a differential engine. The supply of pure deep well water thus derived will be a valuable addition to the Company's resources.

Major Flower, from whose interesting pamphlet, "The River Lee Up-to-date,"[4] these particulars are taken, says: "I have no detail of the amount which this Company has expended in works to improve their water, but it has been something considerable. The last half-yearly Report of the Directors gives the capital expenditure from 1807 to 1893, as, in round figures, two and a-half millions."

As in the case of the New River Company, the early returns were small—the average dividend from the establishment of the Company was 2½ per cent. per annum, and for four years there was no dividend at all.

Quoting from the Report for 1891-92, of the Water Examiner—Major-Genl. Scott—to the Local Government Board, in 1891 the East London supplied daily, on an average, 41,580,135 gallons to 1,158,500 persons in 170,967 houses. A portion of the water so distributed was drawn from the Thames at Sunbury.

The total quantity of water for the year from all sources was 15,176,749,253 gallons.

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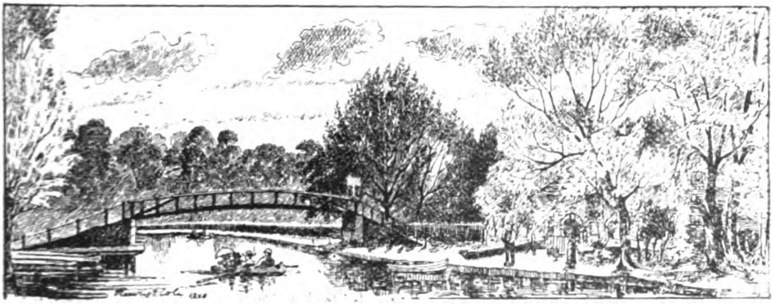
[4] Copies of this little book were given to those on board by Major Flower, and it formed a memento of the occasion well worthy of preservation.

Springhill Reach, Clapton.

The extensive filtering-beds were inspected with much interest, and the conchologists of the party found an immense number of the dead shells of aquatic mollusca in the sand and mud which had been thrown up out of the beds at the periodical cleanings.

Colonel Bryan was very cordially thanked for his interesting demonstrations, which lasted over an hour, and the party then re-embarked and full steam was put on for Tottenham. A constant flow of information on the history and changes the river has undergone, and of the hamlets and buildings passed, was kept up by Major Flower, Mr. Howard, and Mr. Andrew Johnston. The old boating-house on the river, the "Jolly Anglers," was passed, and the High Hill Ferry, a hamlet housing a "longshore" population, who manifest a great interest in boating matters. Several very pretty reaches of river scenery were admired, two or three of which had been sketched by Mr. H. A. Cole for the programme. The heights of Essex could be seen on the right, as for instance, Pole or Beacon Hill, due north of Greenwich, Chingford, with the spire of Old Chingford Church just peeping through the trees, Sewardstone, and High Beach. On passing Higham Hill, Walthamstow, Mr. Andrew Johnston pointed out the house where the late Lord Beaconsfield was educated, and said that the only time he had spoken



High Bridge, Clapton.

to Lord Beaconsfield was when he introduced himself to him in the lobby of the House as representing the division in which Highams was situated. Lord Beaconsfield was very much interested, remembered all about the place, and talked with him about it for a long time. Some particulars were given of the ill-favoured Sewage Works at Tottenham, "the birth-place as well as the grave of many sewage processes," now practically disused, for the whole of the Tottenham and Wood Green sewage is received into the main outfall sewer of the London County Council. Passing onward, on the eastern bank was noted the site of the enlargement of the East London Water Company's Subsiding Reservoirs, the works being in course of construction. On the western side of the river was pointed out the affluent called the intercepting drain of the East London Company, which receives the effluents from Cheshunt Sewage Farm, and also those of Enfield and Edmonton. This was constructed to intercept all foul water west of the East London intake. "River Lee, etc.," pp. 32-34.

THE OLD "FERRY BOAT," TOTTENHAM. (*Drawn June 12th, 1895.*)

At Tottenham Lock, which was the last point reached by the "Salisbury" at the trip last year (E.N., viii., p. 212), the company landed, and walked up to the "Ferry Boat" Inn, just within the County of Essex, where an excellent luncheon was provided.

Aboard again, the barge was moored on the Essex shore, and an ORDINARY MEETING (the 158th) was held, Mr. D. Howard, President, in the Chair.

The minutes of the meeting on June 15th were read and confirmed.

The Secretary said there were a few candidates for election, proposed within the last few days, since the publication of the programme of the meeting. As another meeting would probably not be held for some time, he proposed that Rule IX. should be suspended, and that the candidates should be put up for election at once. This proposal was seconded by the President, and carried unanimously.

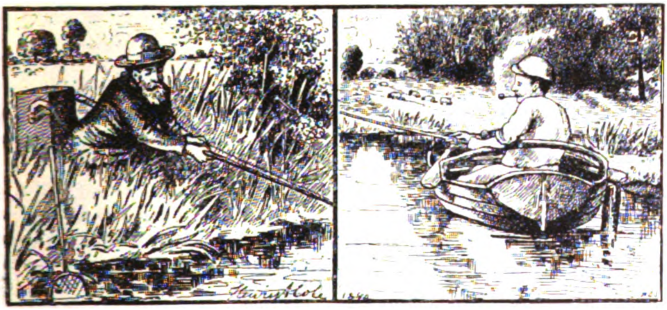
The following were accordingly elected members of the Club: Mr. H. S. Bartleet, Mr. W. Beck, J.P. (Chairman of Waltham Abbey District Council, and member of the Lee Conservancy Board), Mr. Hugh McLachlan, A.R.I.B.A., and Mr. W. Robinson.

Mr. T. V. Holmes, F.G.S., read a short paper, entitled "Geological Notes on a Supposed Earthwork near Harlow Railway Station on the River Stort," in which he dealt with the conclusions arrived at by Mr. Chalkley Gould in a paper lately published by the Essex Archæological Society.

The Secretary read some notes in reply to Mr. Holmes, by Mr. Gould, who was unable to be present (the two papers are printed on pp. 59-70 of the present number).

A short discussion ensued, carried on by Mr. Crouch, Mr. Andrew Johnston, Mr. Howard, and Mr. Holmes, and a vote of thanks was passed to Mr. Holmes for his paper.

The voyage was then continued, under beautiful conditions of weather, through Stonebridge Lock, so called from the lock house being built of stone from old Blackfriars Bridge. On the western side of the river was seen the Tottenham Rifle Range, so largely used by volunteer troops.



Lea Anglers—Professional and Amateur.

The next lock was that known as Pickett's Lock. Passing the sewage farms of Edmonton and Enfield, we arrived at Ponder's End Lock, just below which is the intake of the East London Waterworks Company, known as Kidd's Weir, and a picture of which was given in the report of last year's Lea meeting.

Major Flower was obliged to leave before the termination of the journey, but not before he was most warmly thanked for his great kindness in arranging many of the details of this meeting, which so admirably completed the excursion of last year.

Steam was then put on for Waltham Lock, passing on the west the works of the Lee Navigation and the Royal Small Arms Factory. The party then walked up to Waltham Abbey, where tea was served at the "Cock Hotel." A visit to the Abbey and to the objects of interest in the town completed the programme, and the members left for home by rail, carriages, while some walked home by way of the river or across country to Chingford or Buckhurst Hill.

ANNUAL "FUNGUS FORAY."

SATURDAY, OCTOBER 19TH, 1895.

THE Annual Cryptogamic and Botanical Meeting was held on this day, the headquarters for the assembly being the "King's Oak" Hotel, High Beach, Epping Forest.

The arrangements were precisely similar to last year, and Dr. M. C. Cooke was again referee, his most valuable services being in constant requisition. The members began to assemble at Loughton and Chingford about 11 o'clock, and a conveyance was engaged by the Club to take the various parties quickly up to the best collecting grounds. It is quite unnecessary to enter into any detailed report of the day's work, as this would be but repeating the accounts of former "Forays." The woods near High Beach and Chingford, Honey Lane Quarters, Monks Wood, etc., were well searched for specimens; while Mr. Oldham brought a large number from Woodford Lower Forest, and the Messrs. Cole specimens from Lodge Bushes and elsewhere. A very considerable number of species was obtained, and displayed on the tables in the large room in the Hotel. Dr. Cooke took great pains in naming doubtful species and in giving information to inquirers.

After tea, at 6.30, the usual ORDINARY MEETING (the 159th) was held, the President, Mr. David Howard, F.C.S., in the chair.

Prof. Meldoda called attention to the lamented death of Prof. Babington F.R.S., an old Member of the Club, and of Dr. Wharton, a constant attendant at the Fungus Forays almost from the foundation of the Club.

Dr. Cooke also made some interesting and sympathetic references to these distinguished botanists, and a vote of condolence with their families was passed.

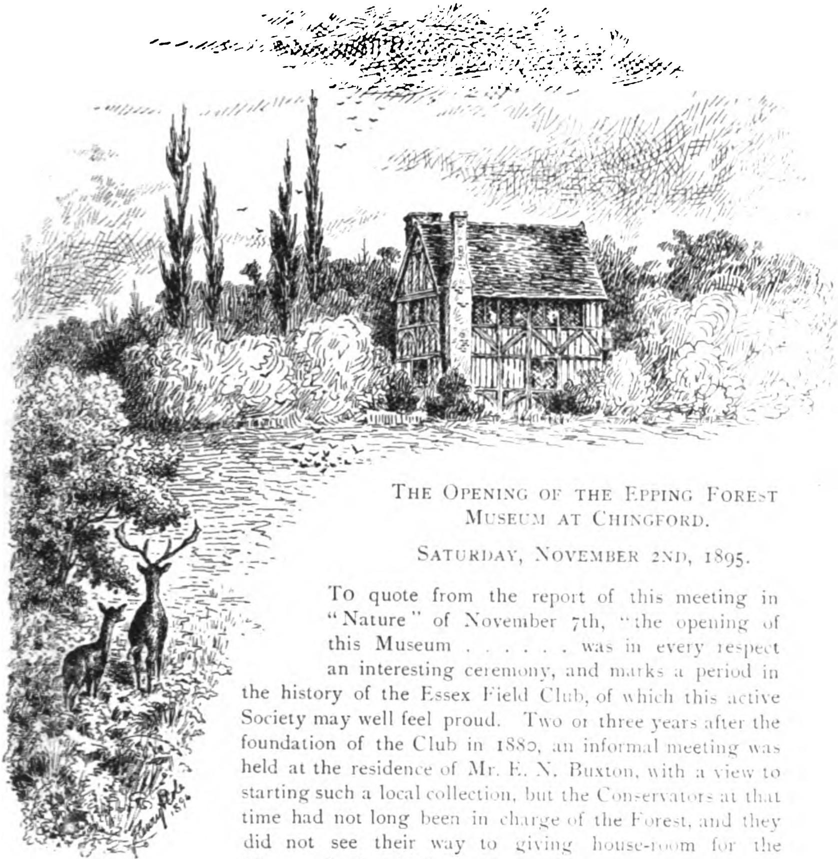
Dr. Cooke then gave his annual report on the observations made with respect to the mycological flora of the Forest, and announced that one new species had been obtained, viz., *Tricholoma duracinus*, Cke., which had been found in Great Britain only once before, at Kew.

Mr. A. B. Rendle, M.A., F.L.S., of the Botanical Department, British Museum, then gave a most interesting Address on the Natural Order of Plants, in which he sketched the development of the modern botanical classifications, and insisted upon the great importance of constant study in the field in order to accurately understand many species.

The President and Prof. Meldola made some very appreciative remarks upon Mr. Rendle's address, and the latter called attention to the indications of greater value being set upon field-work in the future than in the past ten or twenty years, and referred to Prof. J. Dyer's address at the British Association Meeting at Ipswich.

The Rev. W. C. Howell also spoke, and supported the cordial votes of thanks that were passed to Dr. Cooke and Mr. Rendle for their services.

The remainder of the evening was spent in examining the vast number of specimens upon the tables.



THE OPENING OF THE EPPING FOREST MUSEUM AT CHINGFORD.

SATURDAY, NOVEMBER 2ND, 1895.

To quote from the report of this meeting in "Nature" of November 7th, "the opening of this Museum . . . . . . was in every respect an interesting ceremony, and marks a period in the history of the Essex Field Club, of which this active Society may well feel proud. Two or three years after the foundation of the Club in 1880, an informal meeting was held at the residence of Mr. E. N. Buxton, with a view to starting such a local collection, but the Conservators at that time had not long been in charge of the Forest, and they did not see their way to giving house-room for the Museum in the old Lodge known as "Queen Elizabeth's." The founders of the Club, however, have never lost sight of the desirability of having such a collection in the Forest district, and in February, 1894, a Special Meeting of local residents and others was convened, and a local sub-committee formed for the purpose of forwarding the scheme. A subscription list was opened, and a sufficient sum raised to warrant another application to the Conservators for the use of Queen Elizabeth's Lodge. This was granted, and the Banqueting Room, which from time immemorial has been unoccupied and devoid of fittings, has now undergone transformation into a Museum, which was declared open to the public as part of Saturday's proceedings."

It is unnecessary to enter into full details here as to the progress of the fitting up of the Museum, as they will be given by the Hon. Curator (Mr. W. Cole) in his report to the Club at the Annual Meeting in March next. A pamphlet[1] had been drawn up by Mr. Cole descriptive of the Museum, for the purpose of giving visitors some idea of its purpose and scope, and the reader may be referred to this leaflet, and to the prospectus issued by the Local Committee in 1894, as well as to the Report of the Curator for information on these points. In anticipation also of the opening, Mr. I. Chalkley Gould prepared a description of his collection of Romano-British relics from Chigwell, which forms so interesting an exhibit in the Museum.[2]

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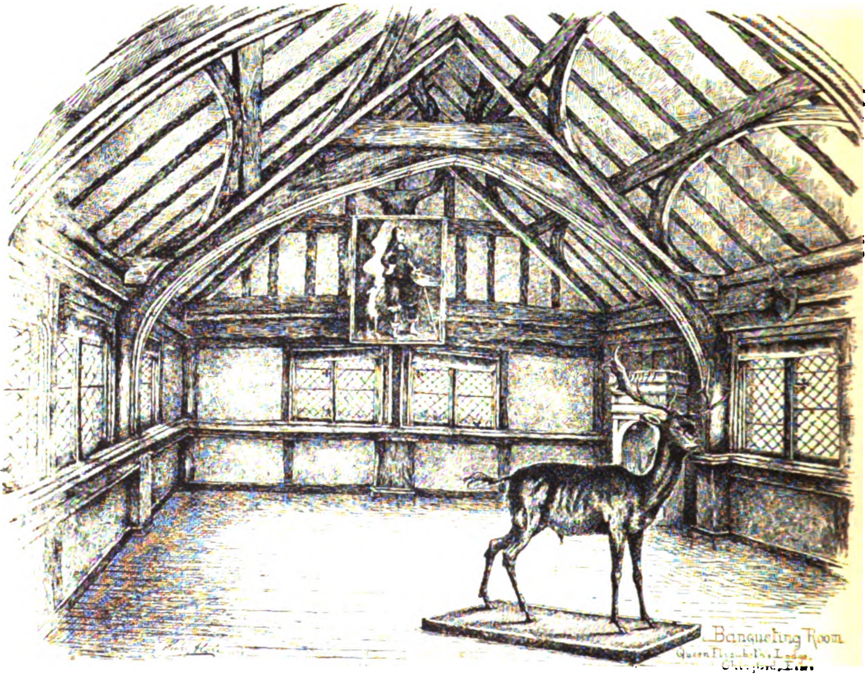
[1] "A Short Account of the Epping Forest Museum." Chingford, November, 1895. On sale at the Museum. Price, 1d.

Mr. Deputy R. C. Halse, Chairman of the Epping Forest Committee of the Corporation of London, very kindly consented to open the Museum, and he was supported by the presence of many Members of the Epping Forest Committee, the Verderers, and the Superintendent of the Forest, Mr. F. McKenzie.



BANQUETING ROOM IN THE LODGE, BEFORE THE ESTABLISHMENT OF THE MUSEUM.

A large and representative assembly of guests and members of the Club assembled at Mr. Butler's "Retreat," near the Lodge (kindly lent for the occasion), at about three o'clock, to receive the Chairman and Committee, who were driven over from Mr. Buxton's house at Buckhurst Hill. Mr. David Howard, President, received the company, and was supported by the Members of the Local Committee, including the Rev. A. F. Russell (Chairman), the Rev. W. T. Dyne,

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[2] "Notes upon the Romano-British Settlement at Chigwell, Essex. With a Description of the Articles exhibited in the Gould Loan Collection in the Epping Forest Museum." By I. Chalkley Gould. Chigwell, 1895. Price, 6d.

Rev. W. L. Wilson, Mr. G. E. Vaughan, Mr. J. H. Wilson, Mr. A. Lockyer (Hon. Treasurer), Mr. W. C. Waller (Hon. Librarian), Mr. R. J. Sheldon, Mr. B. G. Cole, Mr. H. A. Cole, and Mr. W. Cole. Among those present may be noted:

The Epping Forest Committee and the Corporation were represented by Mr. Richard Clarence Halse (Deputy), Chairman of the Committee; Mr. J. Snowden (Deputy), Mr. Cox (Deputy), Mr. Francis McCarthy, C.C., Mr. A. Double, C.C., Mr. Jas. Salmon, F.S.S., Mr. S. Elliot Atkins (Deputy), Mr. Oliver H. Davis (Deputy), Mr. Graham King, Mr. J. Douglas Matthews (Chairman of the Library Committee), Mr. Chas. Welch (City Librarian), and Mr. A. Stanier (Minuting Clerk); with Mr. F. F. McKenzie (Superintendent of the Forest). The Verderers present were Mr. E. North Buxton and Mr. P. Gellatly, and the Members of the Club and guests present included Sir William Flower, F.R.S. (*Director of the British Museum of Natural History*), Prof. R. Meldola, F.R.S., Prof. Boulger, F.L.S., F.G.S., Mr. J. E. Harting, F.L.S., Alderman W. W. Glenny, J.P. (*Vice-Chairman of the Essex County Council*), Mr. F. Chancellor, J.P., Mr. A. Smith Woodward, F.G.S. (*of the Geological Department, British Museum*), and Mrs. Woodward, Hon. Canon Pelham, Rev. W. C. Waller, Rev. J. E. Symus (*Headmaster of the Bancroft's School*), Rev. W. Allen, Mr. J. A. Clark, Mr. Walter Crouch, F.Z.S., and Miss Dora Crouch, Mr. H. G. Day, Mr. Llewellyn Hatton, Dr. J. E. Harting, Dr. F. J. Smith, Mr. G. Shakespeare Smith, Mr. Bruce Cook, Miss M. T. Bentley, Mr. A. Wilde, Mr. Benjamin Winstone, Mrs. and Miss Howard, Miss Double, the Misses Cole, Miss Gibbs, Mr. J. Avery, Mr. A. Stanier, Mr. E. J. Wythes (Copt Hall, Epping), Mr. Graham King, Mr. J. Conquest.

In opening the proceedings, the President, Mr. Howard, said that on behalf of the Essex Field Club, it was a great pleasure to him to have the honour of welcoming the Chairman and so many Members of the Epping Forest Committee and of asking Mr. Halse to open the Museum, of which they had made a beginning in the adjacent house. It had been a matter of very great interest, and one which many of them had wished for many years to see, and its existence was now entirely owing to the very considerate way in which their application for the use, at any rate for a time, of the adjacent building, the Elizabeth Lodge, had been met by the Epping Forest Committee, and to the untiring zeal and energy of their Secretary, Mr. William Cole. It was a very considerable matter to make a Museum worthy of its purpose. To get a number of ill-considered odds and ends together, and put them on mouldy shelves or in dusty cupboards, was not to make a Museum. A Museum must mean something, or it was worse than useless. It was their desire to make it representative of the Natural History, Geology, and History of Epping Forest in its widest sense, and to make the collection worthy of the opportunities of this great forest. From an educational point of view, as well as merely from the point of view of enjoyment, had this Museum been founded. He wished it to be clearly understood that they wanted a great deal of help. They wanted collections, specimens, and money. They had been nobly helped in many directions, and were thankful for that help. Their endeavour would be to make the Museum worthy of its object, and to forward the carrying out of the ideas under which it had been begun.

The Rev. A. F. Russell, speaking for the Local Committee, supported Mr. Howard in the welcome he had given the Forest Committee that day; they were extremely glad to see them. As Mr. Howard had pointed out, the idea of the Museum in Queen Elizabeth's Lodge was no new one. Some twelve years ago a few of those present that day were at a meeting held at Mr. Buxton's house at which the plan was mooted and discussed, but the time had not come. Then they had a meeting in February, 1894, at which a number of scientific gentlemen were present, and also some residents and others, and then it was discovered that the time had come, and they made arrangements for starting that Museum, and a Committee was appointed to carry it out. In arranging a small Museum of this kind two requisites seemed to be necessary. First of all there must be a sufficient amount of local interest taken in the subject; there must be a sufficient number of students of natural history, scientific gentlemen, and those interested in one or more branches of natural history in the place who would come and make use of this Museum for study. Then the second requisite was that they must have a good arrangement in the Museum. He ventured to suggest they would have a sufficient number of local students to make the Museum successful, and they were sure to have satisfactory arrangements while they had Mr. Cole and his brother to help them. He asked Mr. Halse and the Committee not to criticise too severely the arrangements that the Museum Committee had made. The Museum had simply been begun; it was not completed, and they would not be able to complete it until they had sufficient funds in hand and until they had a sufficient number of exhibits lent or given. The purpose of the Museum was to promote an intelligent interest in this forest neighbourhood, and, therefore, was a purpose well worthy of the support of the great Corporation of the City of London. It was to them they owed this Forest as an open space, and therefore they asked them to help maintain and support this Museum by every means in their power, and their presence that day was an assurance to the Committee of their cordial co-operation and support in this matter.

Sir William Flower said he was glad to have an opportunity of expressing his cordial sympathy with this movement. He had always felt that local Museums, scattered in various parts of the country, might do a great deal for promoting an interest in natural history, and he thought that a growth of interest in natural history, would tend very much to elevate and refine and make more agreeable the life of our people. He did not want to point out in any way whatever the practical utility of natural history studies, but in every sense he was sure they were most beneficial. They had, in going through life, so many cares, so many troubles, and so many disagreeable things, that he thought to be brought in contact with nature, to see and admire the beauties placed before us by the Creator, in many ways must be a great source of enjoyment, a most legitimate source of enjoyment, for he thought they all ought to feel that any enjoyment that they could have passing through the world should be cultivated. The love of natural history really did give the power of enjoyment and the power of raising themselves above the petty cares and troubles and worries which they all had, that no one could appreciate but those who had experienced it. He had experienced it, and for that reason should like to see that taste spread as much as possible amongst the community, and there was no such way of spreading that taste as by Museums. He was glad to know that it was not only natural history but also the human history and archæological history of the district that they were going to take up. There were a number of things that might be lost by being scattered about in private hands, which, if collected together in such an institution as this, would convey an idea of the history of the inhabitants of the district in the past time. He believed in this Museum they were going back to the pre-historic flint instruments, and then from that time in the early history of man anything that bore upon the culture and civilisation of the people should be collected together.

Mr. Deputy Halse said as far back as 1883 gentlemen taking an interest in the Forest assembled at the hospitable residence of Mr. E. N. Buxton, and application was made for the use of the Queen Elizabeth Lodge for such a collection, but at that time the Corporation was newly in the saddle as controlling managers of the Forest, and there was some fear entertained by some gentlemen very high in authority that it would be undesirable that they should nominally part with the control of the property to which they had succeeded. Although the notion of forming this Museum slumbered, the gentlemen taking an interest in it did not sleep, and other men had appeared on the scene. Last year application was made to his immediate predecessor, Mr. James Salmon, to bring before the Forest Committee the subject of the formation of this Museum. Mr. Salmon was enthusiastic about anything connected with the Forest, and the Committee were able to see their way, without parting with the control of the building, to give the gentlemen interested in forming the Museum an opportunity of occupying it for that purpose. The Committee retained control of it, and had the power of terminating, if necessary, the occupation of it, but he did not think that was likely to happen in his time, or in the time of any of them. He had the utmost pleasure in the name of the Epping Forest Committee, and he thought he should say in the name of the Lord Mayor and Corporation, of whom this Committee was but a section, in declaring the Museum open, and that from Monday, November 4th, the collections would be available for public inspection.

The party then proceeded to view the Museum, and (again to employ the words of the report in "Nature") "great satisfaction was expressed at the amount of material which had been brought together in a comparatively short time, and with very modest financial means." Some very appreciative notices of the Museum appeared in various newspapers, particularly in the "Field," "Natural Science," the "Essex County Chronicle," the "Essex Times," and many others, and the following passages from the "Daily News" of November 4th, may be taken as a fair description of its contents, as viewed by the representative of that paper :

"The Essex Field Club has done a really good work in establishing the Epping Forest Free Local Museum, which was formally opened on Saturday afternoon. The quaint, well-preserved old-world house, known as Queen Elizabeth's hunting lodge, adjoining the picturesque Forest Hotel at Chingford, is not large, but it serves admirably for the purpose of the moment. The sub-committee of the Club do not pretend that the Museum in its present shape is anything but a beginning, but they well deserved the congratulations and praises spoken by the gentlemen who took part in the proceedings of Saturday. The Museum has a distinct educational character, since it is designed and arranged to illustrate the natural history, archæology, and history of a most interesting district, and the Lodge itself, with its antique staircase and upper banqueting room, is an antiquarian object of rare value. The map of the old Forest of Waltham broadly defines the district covered by the collections in the Museum, and it is curious to note that Epping, which gives the remnant of forest its modern name, was in 1641, which is the date of the last "perambulation," only a purlieu. Chigwell was then almost the centre of the forest, and its boundaries extended from Roydon Hamlet to Stratford-le-Bow in one direction and from the Bourne Brook to the River Lea in another. The Essex Field Club, in making its preparations for the

Museum, had to take in as wide an area as possible. It was thought unwise to limit the source of the collections to the woodlands of Epping Forest now under the fostering care of the Corporation, and this is why the perambulation of Charles I. was agreed upon. It includes the site of Hainault Forest, of which many charming remnants are preserved, and is a collecting ground of something like 60,000 acres. By and by the Museum will include the animals and plants of the Roding and the Lea, and the valley slopes of both rivers, bringing in the Barking and Dagenham marshes. Mr. William Cole, the honorary curator, may be heartily congratulated upon the scope and classification of the collections, which from to-day are open to the public. On the walls of the ancient staircase are maps and views, geological sections, and plans of the Forest, and the visitor to the Museum is first confronted with object lessons in geology, rock specimens from the gravels and fossils from the Boulder Clay demonstrating the glacial conditions which formerly extended over the greater part of the Forest districts, in common with other parts of Essex. There are bones of the rhinoceros, and a mammoth from the brick earth forming the slopes of the Lea Valley, and skulls of wolves and other animals, and mollusca found in its peat beds. The presence of man at this far-away period is shown by the old stone implements lent by Mr. Greenhill from his magnificent private collection, and the specimens from the peat beds show that the small ox, wolf, red-deer, and horse were denizens of the Forest. The objects collected by the Club in its investigations of the Ambresbury and Loughton are illustrations of those camps of the late Celtic age. Roman times are richly recalled by Mr. Chalkley Gould's remains of the Romano-British settlement at Chigwell, arranged by himself, and described by him with minute care. Some of the fragments dug out of the Chigwell site had been probably buried there for 1,600 years. The cemetery afforded many evidences of cremations, but there was only one of burial by inhumation, and the collection includes the actual nails used in the coffin. There are bits of glass, coins, white ware, and utensils, amongst them being fragments of the red Samian pottery. Coming to the existing fauna and flora, there are excellent specimens of the gilled fungi preserved by the late Mr. English, and in connection with the fungi might also be mentioned the Forest mosses. The smaller flowering plants of the district are represented by mounted specimens; the Forest trees and bushes are to form a separate collection, and eventually all the Forest plants will be exhibited in folding frames. There is a fine collection of birds, including hawks, and the long and short-eared owls; several cases of land and fresh-water shells, a numerous assortment of insects, snakes, adders, lizards, and a very complete array of eggs of birds known to nest in the Forest. The mammalia are to be taken in hand forthwith, and one of the objects in view is to illustrate the interesting dark race of fallow deer which have inhabited the Forest from time immemorial."

One very notable exhibit is the collection of about 500 coloured plates of nearly all the species of Gilled Fungi (*Hymenomycetes*) of Epping Forest, presented by Dr. M. C. Cooke. Aid in gift or loan of specimens, and in arranging the same, was gratefully acknowledged from Mr. T. Hay Wilson, the Rev. J. W. Kenworthy, Mr. Greenhill, Mr. Chalkley Gould, Dr. M. C. Cooke, Mr. J. T. Powell, Messrs. W. and B. G. Cole, Mr. J. A. Clark, Mr. Oldham, Mr. Coales, Mr. Walter Crouch, Mr. H. Day, Mr. Hatton, Mr. H. A. Cole, Mr. T. V. Holmes, Mr. Winstone, Mr. Waller, the Epping Forest Committee, Messrs. Chapman and Hall, Messrs. Cassells, and Mr. Stanford, while Mr. H. A. Cole's aid in constructing and fitting up cases, and in many other ways, had been of the greatest value.

After the inspection of the collections, tea was taken at the Royal Forest Hotel, Chingford, at which about ninety members and visitors sat down. The subsequent proceedings may well be given in the words of the report in "Nature."

"At a meeting of the Club held after tea, the President moved a vote of thanks to Mr. William Cole and his coadjutors for the large amount of work which they had voluntarily done on behalf of the Museum. This was warmly seconded by the Rev. A. F. Russell, the Rector of Chingford, who is Chairman of the Local Sub-Committee. Mr. Cole having acknowleged the vote of thanks, Mr. A. Smith Woodward (of the British Museum) then gave a short address, in the course of which he pointed out the essential requirements that the Museum should fulfil in order to be of real use, and commented most favourably upon the arrangement of the collections, their contents, and their mode of display.

"Sir William Flower expressed his concurrence with Mr. Woodward's remarks, and made some further observations and suggestions, especially dwelling upon the importance of taking steps to insure the permanence of the Museum when those who had laboured so well for its foundation were no longer able to carry on the work. In the course of his remarks he paid a high tribute to the general work of the Essex Field Club, of which he had been an Honorary Member almost from the time of its foundation.

DISTANT VIEW OF QUEEN ELIZABETH'S LODGE.

"Prof. Meldola, in proposing a vote of thanks to Mr. Deputy Halse, pointed out that the element of permanence to which Sir William Flower had alluded was most likely to accrue from their association with the Epping Forest Committee.

"This vote having been seconded by Mr. E. N. Buxton, and replied to by Mr. Halse, Mr. J. E. Harting made some remarks on the danger of encouraging promiscuous 'collecting' by schoolboys, and the proceedings terminated.

"Favoured by an exceptionally brilliant autumnal afternoon, the meeting was a distinct success, and must have given great satisfaction to its promoters. The Museum is necessarily small, but a good beginning has been made, and the time may be looked forward to when increased accommodation will be required. The feature which most strongly commends it to students of natural science, and lovers of the Forest generally, is the purely local character of the collections. No more appropriate use of Queen Elizabeth's Lodge could possibly have been made, and the Corporation of London have done wisely in allowing the Essex Field Club to found an institution which, however small and unpretentious, is, even as at present appointed, a distinct boon to all frequenters of the Epping Forest District."

ON AN ANCIENT OAK AT CHIGNAL ST. JAMES, WITH OBSERVATIONS ON THE FIELD-NAME OF "PUTTOCK'S LEES."

By MILLER CHRISTY, F.L.S.

AMONG the more ancient Oak trees in the county of Essex is one with which I have long been familiar in the adjoining parish of Chignal St. James. Although not of sufficient grandeur to have been entitled to a notice in Mr. Shenstone's interesting paper on "The Oak Tree in Essex" (E.N., vol. viii., 1894, pp. 89-117), it is, undoubtedly, a very ancient tree.

For a long time past, the bole of the tree has been nothing more than a thin, perfectly hollow shell; whilst one side, for about one-third of the circumference, has been missing. Completing the circle of the circumference, the bole had a girth of about 25 feet at one foot from the ground. As might be expected, the crown of branches springing from such a trunk was but small.

The almost-total destruction of the venerable tree during the last few weeks (I am writing on September 24th, 1895), by a fire which some mischievous urchin lit inside the bole, affords a fitting opportunity for a few words concerning it.

In the first place, the tree has, from time immemorial, formed a boundary-mark between the parishes of Chignal St. James and Writtle. In an old manuscript, "Terrier," in my possession, describing "A Perambulation of the Parish of Chignal St. James and St. Mary, made on the 25th of May, 1797," after recounting the route followed from the start, the narrative states that the perambulating parishioners, ten in number, passed straight "on to a ground-mark in y^{e} field called Hollys [now called Hully], thro' the Valley bearing to the right to the lower corner of Puttock's Lees; then straight on over the hedge into Puttock's Lees and mark'd a sallow; then across the Bottom,[1] some little distance from the hedge, to an

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[1] "Mr. Surrey [then residing at Pengy Mill Farm] says the whole of Puttock's Lees lies in Chignal Parish."

Oak Pollard mark'd; then over the hedge straight on down Broad Field [still so called] to the cross path;[2] then straight on the right hand to an oak mark'd at the Style; then to the left over the hedge," etc. The last-named oak is the one in question; and, within the last few years, I have seen on it a large notch, which I have always supposed to be the "mark" cut in it with a hatchet, when, in former times, the boundaries of the parish were "perambulated"—a custom which was maintained in Chignal until at least as late as the year 1836.

Another interesting thing in connection with the tree is the fact that the former name of the field in the hedgerow of which it stands was (as stated above) "Puttock's Lees." This name survived until at least the year 1810, as I find "Puttock's Leys" and "Puttock's Leaz" on maps of the parish of that date; but, soon after that time, the field was thrown into the present Broad Field.

Now the Buzzard and the Kite (though extinct as breeding species in Essex) were formerly not uncommon, and were known locally by the name of "Puttock"; whilst "Lees," "Leys," "Leas," or "Leaz" (all forms of the same word) are, no doubt, corrupted from the very ancient and now-obsolete English word "Leasow," meaning a meadow or a pasture, which is probably derived from the Anglo-Saxon *læs*, a meadow. Tusser (1557) uses the word "lease" for a pasture. The word still survives locally, chiefly in names of fields. Thus, in Mr. W. C. Waller's interesting paper on "Essex Field Names,"[3] we meet with a "Lees Field" in Hatfield, a "Great Leighs" and a "Cowleaze" in Stanford Rivers, a "Wood Leighs" in Great Parndon, a "Crab's Leys" in Fyfield, and with many other similar combinations. There is also a meadow known as "The Lays" in Roxwell parish, but adjoining the Chignal Boundary, and a Sty Lees in Broomfield.

We get, therefore, "Buzzard's Field" as the modernised name of "Puttock's Lees"; and there can be no doubt whatever that the name is a relic of the time—perhaps two centuries or more ago, for field-names are very enduring—when a Buzzard or a Kite regularly bred in some large tree in the hedgerow of the field—probably in the very oak tree in question, as there is no other large or ancient tree anywhere in the immediate vicinity. According to Mr. Waller,[4] there is still also a "Puttock's Oak Field" in Roydon parish.

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[2] "Mr. Crush [then residing at Stevens Farm] has here altered the land."

[3] "Trans. Essex Arch. Soc.," vol. v., p. 144.

[4] *Loc. cit.*, p. 172.

NOTES ON ESSEX WORMS (OLIGOCHÆTA).

DESCRIPTION OF A SPECIES NEW TO BRITAIN (HENLEA VENTRICULOSA, D'UDEKEM), AND OF A GENUS AND SPECIES NEW TO SCIENCE (DICHÆTA CURVISETOSA, FRIEND.), BOTH FROM ESSEX.

By REV. HILDERIC FRIEND, M.A., F.L.S.

I.—Henlea ventriculosa, D'Udekem.

IN May, 1892, I received from Mr. William Allen, a member of the Essex Field Club, a consignment of worms from the Essex side of London, the exact locality not being carefully defined. In addition to the earthworms were some specimens which did not then come in for treatment in connection with my series of papers[1] on the terricolous species, and these I have hitherto failed to place on record. The publication of Mr. Beddard's "Monograph of the Oligochæta"[2] having made it necessary for me to look over some of my old notes, I find it recorded that the species from Essex was *Enchytræus ventriculosus*, D'Udekem. The genus has since been renamed *Henlea* by Michaelsen, and five well-known species placed thereunder. Little is known about the British species of *Henlea*, but I have recorded *H. leptodera* for Yorkshire, and, as far as I am aware, this is the first British record of *H. ventriculosa*. I made drawings of the worm when received which are sufficient to render the identification certain, though in one or two particulars my notes and drawings differ from the descriptions given by others. This may be due to the fact that the British forms have undergone slight modification. Mr. Beddard's definition is as follows:

"Length, 15-20 mm.; number of segments, 60; setæ straight or slightly bent to right or left, 4-9: four œsophageal glands (and one pair of spermathecæ); hab., Germany, Denmark, Bohemia, Italy, Belgium, New Zealand, Asia; terrestrial."

I have drawings of the setæ which are slightly curved, and my notes state that there are 3-5 in each bundle, thus differing from the type. Mr. Beddard says the four glands lie in the eighth

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[1] See Mr. Friend's papers on "British Annelids, with especial reference to the Earthworms of Essex," in volumes v. and vi. of THE ESSEX NATURALIST.—ED.

[2] "A Monograph of the Order Oligochæta." By F. E. Beddard, F.R.S. 4to, pp. xii. 769, with five plates. Oxford: Clarendon Press, 1895. Price £2 2s.—ED.

segment, and are simple diverticula. My figures show them in segment seven, highly developed. It would be interesting to obtain fresh material for a fuller comparison with the newest account. Perhaps some collector will be good enough to look out for this species, and forward them to me for the purpose.

II.—Dichæta curvisetosa, Nov. sp. et. Gen.

Some time ago I received from Dr. Wheeler, of Chelmsford,[3] a solitary specimen of a Freshwater Worm preserved in glycerine, which presented so many unusual features that I hesitated to publish an account of the same on the strength of a solitary specimen. Now that Mr. Beddard's work has been published, however, I feel that it is due to other workers in this field that I should state the facts.

The worm was four inches in length, of a very lively nature when first discovered, and having all the appearance (from its great fineness and length) of a moving hair or living thread. I was instantly struck by the fact that it possessed setæ on the very first segment. This was a totally new feature; but I find that Schmarda has figured another species with the same peculiarity. Then I observed that there were no dorsal setæ, and the ventral bundles had been reduced to their lowest possible limit—the result being the unique number of two setæ on each segment. The head was long and narrow, and from this and the other characters I conclude that it is a new genus belonging to the *Chætogaster* group. As it was necessary to suggest some name by means of which the worm can in future be discussed, I have fixed upon the bisetose character for the generic name, and called it *Dichæta*, quite a different term from the well-established *Diachæta*. I regret that I have never been able to obtain a duplicate, and hope that this note may lead some one living in Chelmsford to make careful search for further specimens.

7, *Fern Bank, Cockermouth, January 3rd*, 1896.

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[3] See ESSEX NATURALIST, vol. vi., p. 189.

NOTES ON A MAP INCLUDING THE GREATER PART OF SOUTH-EASTERN ENGLAND.

RECENTLY ISSUED BY THE GEOLOGICAL SURVEY.

By T. V. HOLMES, F.G.S (*Vice-President*).

[*Read February 8th, 1896.*]

THIS map, which is known as Index Sheet No. 12, is the first issued by the Geological Survey which has been colour-printed and not coloured by hand. The results of this alteration are greater accuracy than is possible with hand-coloured maps, and a reduction of price from 10s. 6d. to 2s. 6d., which brings it within the reach of all persons interested in the district within a radius of fifty or sixty miles from London. The scale of the map is four miles to the inch, and, as the railways and chief roads are marked, it furnishes (if mounted to fold), apart from the geological information it gives, a useful guide to the traveller by railway.

Of course, on a map of this scale it has been found necessary to omit various superficial deposits for the sake of greater general clearness. Those not shown are the Glacial Drift, and the patches of gravel and loam to be found here and there in various positions, from our hill-tops to our river valleys, which are all post-Pliocene in age, and almost all newer than the Glacial Drift. To have added these would have been to introduce obscurity, especially in Essex, where, over a large portion of the county, the underlying Tertiary rocks would have appeared only as small irregular spots. South of the Thames the obscurity would have been much less, owing to the absence of the Glacial Drift, but as these superficial beds everywhere lie indiscriminately on rocks of various ages they would, even in Kent and Surrey, have made many geological boundaries indistinct which are now obvious at a glance.

The area included in Index Sheet No. 12 is that of the whole of the counties of Essex, Hertford, Middlesex, Surrey, and Kent, with the greater part of Sussex, and portions of Hampshire, Berkshire, Buckinghamshire, Bedfordshire, Cambridgeshire, and Suffolk. The coast-line extends from Orford in Suffolk to Rye and Winchelsea in Sussex.

Some years ago (ESSEX NATURALIST, vol. ii., pp. 21-33) I took an opportunity of pointing out the great advantages of drift maps over non-drift maps as regards Essex, and the comparative worthlessness of non-drift maps of that county. But the maps of which I then spoke were the ordinary maps on the scale of one inch to the mile, each of which shows but a small portion of a single county, not one of four miles to the inch which includes an area in which Essex occupies about one-fifth. Indispensable as are drift maps to residents in Essex, who as landowners, farmers, or members of the County, or of some District, Council are mainly interested in the uppermost 10 ft., 20 ft. or 50 ft. of strata, the case is altered when the information required is the general geological structure of a very much larger district. To the Essex resident, for example, it may be of little interest to be well informed as to the general structure of the London Basin, and of the utmost importance to know whether a certain group of cottages stands upon Boulder Clay—shown only on a Drift Map—or upon London Clay. If they are upon Boulder Clay a good water supply is probably obtainable for them on sinking some 10 ft. or 20 ft.; if upon London Clay, sinking to a depth of 200. ft or 300 ft., may, perhaps, be useless. Again, a remarkable case occurred recently showing the delusive nature of non-drift maps as evidence on the nature of the soil of Essex. When the Geologists' Association visited Chelmsford in June last year, a geological friend, Mr. H. W. Monckton, who was unable to be present, kindly sent me some notes on the geological nature of the land which had gone out of cultivation in Essex, and which he found to be mainly where the soil is London (see *ante*, p. 70) Clay. He also pointed out that in Mr. Hunter Pringle's Report on the Ongar, Chelmsford, Maldon, and Braintree districts (which had been published as a Blue Book, and was largely referred to in the House of Commons during the debate on Agricultural Depression, July 11th, 1894), there was the extraordinary statement on p. 36: "The soil of Essex, with the exception of two small patches, is geologically classed as London Clay."

Now, this is evidently a mistake which arose from the consultation of a non-drift map, which would show—like Index Sheet No. 12—London Clay extending over the whole of Essex except in the north-west around Saffron Walden and in the south between Purfleet and East Tilbury. For a single glance at a drift map would have shown that the Glacial Drift alone covers more of the surface of Essex than the London Clay does. But, as I have already remarked, the very fact that the surface of Essex is more largely covered by superficial beds than the rest of the district included in Index Sheet No. 12, makes the omission of the various drifts a special gain as regards that part of that map. For its use is not to give sound notions respecting the soil of Essex, but clear information on the general structure of the London Basin. And it would need a very keen and practised eye to trace the outcrop of the London Clay beneath the Boulder Clay from Bishop's Stortford to Sudbury and thence to Ipswich but for the omission of the Glacial Drift.

In Index Sheet No. 12, the newest beds shown, with the exception of the alluvium of the rivers, are those known as the Coralline, Red and Norwich "Crags," with the Chillesford Beds; and, south of the Thames, the deposits discovered on the Chalk Downs near Lenham in Kent by Mr. Clement Reid. These all belong to the Pliocene system, and cover a considerable area of ground around Ipswich. Then, next in date are the considerable patch of (Eocene) Bagshot Beds, between Guildford and Windsor, with the smaller outliers to be seen here and there, especially in South Essex, around Brentwood and at Rayleigh. Then comes the London Clay, which occupies a very much larger proportion of the surface than any other Eocene formation, while the lowest Tertiary deposits, the Thanet Sand and the Woolwich and Reading Beds, with those of the Oldhaven and Blackheath series, appear as a narrow band on the outer edge of the London Clay, along a line ranging from Reading W. and N. of Windsor to Ware, Bishop's Stortford, Sudbury and Ipswich on the northern edge of the Tertiary Basin, and on the southern from Farnham and Guildford to Epsom and Croydon, and thence to Rochester, Canterbury and Sandwich. The Tertiary Beds of the London Basin thus widen eastward and narrow westward. Then we have a Chalk district beyond, that is, south of the Tertiary Beds in Kent and Surrey, and also north of them in north-western Essex, Bedfordshire, and Buckinghamshire: while beds older than the Chalk may be seen in the Weald of Kent, Surrey, and Sussex, and again at the north-west corner of the map beyond Prince's Risborough, Dunstable, Hitchin and Shelford. The oldest beds shown in Index Sheet No. 12 are some belonging to the Upper Lias, a little beyond Wolverton, on the London and North-Western Railway.

But my object this evening is not to discourse on the Geology of the London Basin, but to bring under your notice Index Sheet No. 12, to point out its merits, and the novelty attending it as the first colour-printed map issued by the Geological Survey. I wish also to note its unprecedentedly low price of 2s. 6d. It is in the highest degree desirable that its merits and existence should be widely known as, should its sale be large, other maps, illustrating districts of similar size, will be published at similar prices. But that will occur only in the event of this map turning out to be a commercial success. And when we remember how many cheap and admirable Government publications remain unknown to thousands (who would purchase them did they know of their existence) owing to the utter neglect of Government Departments to give them any fair chance of being known and sold—a neglect that would ruin any private firm—I do not think you will charge me with unnecessarily taking up your time in calling attention to this new departure in Geological Maps.[1]

DISCOVERY OF MAMMALIAN REMAINS AT GREAT YELDHAM, ESSEX.

By T. V. HOLMES, F.G.S., WITH NOTES BY E. T. NEWTON, F.R.S., F.G.S.

TOWARDS the end of February, 1896, I received a letter from Mr. E. A. Fitch, enclosing one sent to him by Mr. T. Goodchild, of Great Yeldham Hall, in which the latter gentleman mentioned the discovery of bones, antlers, etc., in a brickyard close to Yeldham Railway Station. Mr. Fitch very kindly offered to go with me to the spot, and, accompanied by Mr. E. T. Newton, F.R.S., on behalf of the Geological Survey, we visited Great Yeldham on March 5th, 1896.

On arrival, Mr. Goodchild at once conducted us to the brickyard about 200 yards west of the Railway Station, which is marked on both the old and the newer ordnance maps, and has thus evidently been a brickfield for many years. It had, however, at the time of our visit, a general aspect of disuse and decay, sheds and other buildings shown on the six-inch to the mile map being either ruinous or having disappeared, and the sections being obscured and overgrown. In the Geological Survey Memoir, on Sheet 47 (which includes Essex north of a straight line from the junction of the Lea and Stort to

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[1] Mr. Holmes has kindly presented a copy of the map above described to the Forest Museum. It may be useful to add that the sole official agent for the sale of the Government Maps is Stanford, Charing Cross, London.—ED.

Wickham Bishop, and west of another from Sudbury across Tiptree Heath, with portions of adjacent counties), Mr. Whitaker gives the following account of the section seen by him at this brickyard. The memoir was published in 1878, and as Mr. Whitaker's remarks are very brief they are here given in full. (p. 68.)

'At the brickyard just west of Yeldham Station I saw the following section with Mr. Bennett, who remarks that the bones had been split open (? for the sake of their marrow), and that amongst them was part of a deer's horn :—

> Brick-earth and gravel up to 8 or 9 feet.
> Lighter-coloured brick earth, with bones, 2 feet.
> Black, sandy, peaty earth, with land and freshwater shells, said to be 6 feet.—W.W."

We found that there had been some recent digging close to, but south of, the ruined brick-kiln, which exposed a section consisting of brick-earth and gravel lying somewhat irregularly on bands of light-coloured clayey or sandy loam or brick-earth. We also heard of the existence of strata resembling the "black, sandy, peaty earth," etc., seen by Mr. Whitaker towards the bottom of the section, but the pit was filled with water up to a level which prevented us from seeing anything below 2 ft. to 2 ft. 6 in. of light-coloured brick-earth. In this light-coloured brick-earth I noticed some small pebbles of chalk. We were told that the bones we afterwards saw came from this level.

But though we were less fortunate than Messrs. Whitaker and Bennett as regards the section, we were decidedly more favoured as regards the bones. For those recently found at this brickyard had been carefully preserved by a gentleman living about half-a-mile away, Mr. Wade of Spayne's Hall. Mr. Wade not only permitted us to inspect his collection, but very kindly offered Mr. Newton any specimens he might wish to obtain for the Museum of Practical Geology, Jermyn Street, London. Among a large number of bones, many of which were insufficiently preserved for identification, Mr. Newton detected many portions of the antlers of the Red Deer, some teeth of a Bear, bones of a Rhinoceros, and part of the tooth of an Elephant. But as he has kindly sent me some notes on the bones, I prefer to give his own words. He says:

"The Mammalian remains recently unearthed in the brick-pit are for the most part in a very fragmentary condition, but this seems to be due chiefly to the process of extraction, and not to the fragility of the fossils themselves. It is due to the efforts of Mr. Wade and Mr. Goodchild that these remains have been preserved, and not destroyed like others found in this pit some years ago. Among the specimens preserved by Mr. Wade, and those still in the hands of the workman at the pit, we were able to detect evidence of six distinct forms of mammals, some of which are now extinct, and are characteristic of the Pleistocene Age, as the Elephant and Rhinoceros, while others are of interest as being of somewhat rare occurrence in beds of this age, as the Brown Bear and the Roebuck. The extinct Ox and the Red Deer are among the commonest of Pleistocene forms.

"The Elephant is represented by a fragment of a tooth, insufficient for definite determination, but probably belonging to *Elephas primigenius* (Mammoth). The Rhinoceros is, undoubtedly, *Rhinoceros leptorhinus*; portions of a lower jaw with grinding-teeth have been found. The extinct Ox (*Bos taurus*, var. *primigenius*) is almost certainly represented by some large grinding-teeth and foot-bones; but the characteristic skull and horn cores have not been met with. Many fragments of the antlers and limb bones of the Red Deer (*Cervus elaphus*) were among the remains, and seem to be more abundant than those of any other species. The Roebuck (*Capreolus caprea*) is shown to be present by a single antler, which is interesting as this animal is by no means common in Pleistocene beds. The Brown Bear (*Ursus arctos*) is another somewhat rare form in beds of this age, and does not seem to have been hitherto recorded in Essex. Although once a native of Britain, the Brown Bear appears to have been exterminated some time before the Norman Conquest. The four upper grinding teeth and a canine tooth of this Bear, which have been found here, are in a perfect condition, and make one hopeful that more complete specimens of Pleistocene mammals will yet be met with at Great Yeldham.

"Thanks to the generosity of Mr. C. Wade, examples of all the species above mentioned are now preserved in the Museum of Practical Geology, Jermyn Street, London."

As regards the age of the deposits at the Great Yeldham Brickyard, there can be no doubt that they should be classed (as Mr. Whitaker has done in the Memoir on Sheet 47) as Post Glacial, in the sense of being of later date than the Chalky Boulder Clay which covers the surface of most of northern Essex, except where, in the valleys of the various streams, lower beds are exposed. They appear to have been deposited in a slight hollow on the surface of the Boulder Clay. Though, at present, a tiny stream flows through them and empties itself into the Colne close to the White Hart Inn, they are evidently not deposits laid down by the stream, but beds which already existed when it began to flow. They are, therefore, decidedly more ancient than the beds of brick-earth, etc., in the valley of the Cam at Chelmsford, about twenty miles S.S.W., in which mammoth and other remains have been discovered (*see* ESSEX NATURALIST, ix., pp. 10-20), for at Chelmsford the brick-earth is a deposit not merely post-Glacial, but one made by a river belonging to the existing system. A comparison between the mammalian fauna found at Chelmsford and at Great Yeldham shows that while *Elephas primigenius* and *Bos taurus* var. *primigenius* are common to both places, the Yeldham Rhinoceros is the small-nosed form, *R. leptorhinus*, that of Chelmsford the woolly Rhinoceros, *R. tichorhinus*. The Hippopotamus appears in the Chelmsford, but not in the Yeldham list. However, it is satisfactory to know that the preservation of any mammalian remains which may in future be found there is ensured by the near residence of Messrs. Wade and Goodchild at Great Yeldham.

It may be worth noting here, for the benefit of Essex or other photographers of geological sections, that we saw an extremely clear and beautiful section at Great Yeldham, a few yards south of the stream which flows into the Colne south of the White Hart Inn. And we passed another, of less but considerable interest, on the western side of Sandy Lane, on the outskirts of Castle Hedingham. Both are in the gravel belonging to the Glacial Period which underlies the Boulder Clay. And we were pleased to see the Great Yeldham Oak still standing at the junction of three roads near Stone Bridge, though only by the aid of much "restoration" in the shape of brickwork about its base.

POTASH-MAKING IN ESSEX: A LOST RURAL INDUSTRY.

By HENRY LAVER, M.R.C.S., F.L.S., F.S.A. *(Vice-President).*

[*Read November 24th, 1894.*]

IT is often said, that there is now no fear of an art being lost, since the printing press has become such an active agent in recording events and the teachings of science, and that, had it been invented sooner, we should not have had to regret so frequently as we do, the loss of the knowledge how various arts were carried out. All this may have some truth in it, but still there are many manufacturing processes which have disappeared, and of which no records are in print although the press had then been invented; processes which had, and would still have, great value if those engaged in the particular arts to which they relate could re-discover them.

Several of our rural industries also have gone without any records remaining from which those who may come after us could re-introduce them. At one time, the manufacture of woollen fabrics of a particular character found employment for thousands of people in the district around Colchester, and there are many records remaining of the amount of woollen goods made and of the number of workers, but there is no account of what the materials were like when made, nor of the processes in use in the manufacture, and to a great extent this is therefore a lost art. The Press records the commercial value of a manufacture, but rarely the processes adopted in its practical working out.

An instance, as far as Britain is concerned, of a lost art, or perhaps more correctly a lost manufacture, is that of *Potash-Making*; and of this also there are few or no records, excepting in some old chemical authors.

[Since the reading of this paper I have to thank our member, John Spiller, Esq., F.C.S., for kindly sending me the following extract from "Chemical Essays," by R. Watson, D.D., F.R.S., Regius Professor of Divinity in the University of Cambridge (5th Edition, 5 vols. London, 1789). The passage is, I think, worthy of insertion here, as it gives the reason for the name "Potash," and because it mentions that some of the experiments from which the conclusions were drawn, were made in Essex. To a certain extent it confirms the opinion I have expressed; it gives the results of the manufacture but not the details of the economical processes, as carried out in this county:

Essay III.—Of Saline Substances (*Vol. i., pp. 130-135.* " . . . The ashes of most other vegetables, as well as those of maritime plants, yield a salt which has many properties in common with the mineral fixed alkali; but not having all the properties of that salt, it has for the sake of perspicuity been called the *vegetable fixed alkali.* Both the mineral and the vegetable fixed alkali are prepared by boiling the ashes, to extract the salt from the earth; the water containing the salt in solution is then evaporated so as to leave the salt dry. From this manner of preparing them, these salts have been often called *lixivial* salts, *lix* and *lixivium* both signifying a ley made with ashes. The operation of evaporating the water is performed in large iron or copper pots; and from this circumstance these alkaline salts, especially the vegetable fixed alkali, have come under the name of *pot-ash.*

"Great piles of wood are, in many countries, burnt for the express purpose of obtaining pot-ash. From the following experiments, some notion may be formed of the large quantities of wood which must be burned in order to obtain even a small portion of pot-ash.

"I desired a friend in Essex, who had plenty of dry oak billets, to ascertain the quantity of ashes which a certain weight of the wood would yield. He made the experiment with every possible precaution, and from 106 pounds, avoirdupois weight, of dry peeled oak, he obtained 19 ounces of ashes. I treated these ashes after the same manner in which I had endeavoured to ascertain the proportion of earth and saline matter in barilla, and kelp ashes; and from the 19 ounces obtained rather more than one ounce and a quarter of saline matter. From several repetitions of the experiment with ashes of the same kind it may be concluded that 15 ounces of these ashes contained 14 ounces of earth, not soluble in water, and one ounce of saline matter: from this proportion it may be easily collected [*Sic*, probably a slip for 'calculated.'—J. S.] that above 1,300 tons of dry oak, and probably above 1,800 tons of green oak, must be burned in order to obtain one ton of pot-ash.

"The makers of pot-ash generally buy the wood ashes by the bushel, and sell the pot-ash by the ton; but as the ashes out of different woods, and indeed of different parts of the same wood, probably contain very different portions of saline matter, it cannot be expected that we should have any very uniform accounts of the number of bushels of ashes requisite to make a ton of pot-ash. Some dealers in this article are of opinion that a ton of pot-ash may be procured from 400 bushels of ashes; others, from 450; others, from 560 of the best ashes; and others, lastly, from 700 bushels, at a medium, of good and bad ashes.[1] I find that a bushel of the dry ashes, which are sold by the country people who burn wood to our soap-makers in Cambridge, weighs at a medium 58 lbs.; hence, supposing every 15 lbs. of such ashes to contain 1 lb. of saline matter, it will follow that 580 bushels of such ashes would give one ton of saline matter. This correspondence with the accounts given by the pot-ash makers, confirms the analysis of the oak ashes before-mentioned.

"Under the direction and patronage of the Society for the Encouragement of Arts, Manufactures, and Commerce, large quantities of pot-ash have been made in America since the year 1763; and it would be a great saving to the nation if it could be made in sufficient quantities in any part of the dominions of Great Britain, since we are reckoned to pay to Russia, and other sovereign states, not less than £150,000 a year for pot-ash."[2]]

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[1] Lewis's "Experiments on American Potash," p. 6.

[2] Dossie's "Mem. of Agriculture," vol. i., p. 248.

Up to the earlier years of this century Potash making was a very common rural industry in Essex, and possibly just as frequent elsewhere, but, as I am writing for Essex readers, I shall confine my remarks in a great measure to its existence in this county.

As a proof of the frequency of Potash Works, it is only necessary to look over a large scale map of Essex and note how very often the name "Potash-Farm," "Potash-Corner," "Potash-Field," occur. Now, every one of these marks the site of a so-called "Potash," the usual name by which these works were known. Common as these "Potashes" evidently were, and recently as this manufacture ceased, it is very extraordinary how very few people seem to know anything of the processes, or even where they were carried on.

Had a manufacture of this character and importance to the rural population disappeared a few years earlier than it did, some knowledge of the craft would have lingered amongst the country people, and many who never saw one would have heard tales from their fathers and grandfathers of the situation of "Potashes," and of the mode of manufacture. But all traditionary knowledge has now ceased in our villages; so few remain in their birthplaces that traditions are not passed on from father to son, and the result is that most villagers under fifty years of age know nothing of the later history of their district, excepting in those matters which have come under their own observation, or which they may have seen in print. It is useless, therefore, to make inquiries of any people of the age mentioned, with reference to events which may have occurred in their districts, even if they happened only a few years before their birth. For these reasons I have been unable to get any information or assistance in my inquiries respecting Potashes, unless the person I questioned was approaching old age.

I think the decay of tradition and traditionary knowledge one of the worst features of our time; instead of people feeling any interest in, and being proud of, their own part of the country, and therefore having local patriotic ideas, all these sentiments are totally absent. What is true of small districts is equally true of the kingdom at large; the loss of traditionary knowledge in the one section of the community produces loss of interest and patriotism in both. That patriotism as a natural characteristic is declining, is a statement all must assent to who pay any attention to the news of the day, and to every thinking person it must be a matter for regret: for a kingdom without patriotism is in as bad a state as a regiment without *esprit de corps*, and perhaps in a worse.

From some aged people I have received considerable help, but there seem to be very few persons living who are practically conversant with the methods of manufacture. In fact, I have only found two such; one of whom, Peter Smith at Tolleshunt Knights, is about ninety years old; and another, John Chisnell, aged seventy-six, now in Colchester Union House, who in his childhood worked at a "Potash" just over the border of the county, in Suffolk.

In my younger days I remember visiting the "Potash" at Rochford, Essex, and later, that is, about forty-five years ago, I saw the whole process at the Tolleshunt-D'Arcy "Potash." Fortunately I did so, or I question whether I should have obtained so clear an account as I was thus enabled to draw up from either of the above mentioned old men.

From the description of the process given below anyone might be able, supposing circumstances were favourable, to resuscitate the manufacture in our county.

Various causes brought about the decay of this industry; the most important one was the general use of coal as a fuel, in the place of wood. Formerly, wood was the only fuel in farmhouse and cottage alike, as will be mentioned when giving the information derived from some of my aged friends, but when this became scarce, as it did by the destruction of woods and broad hedgerows at the end of the last and beginning of the present century, it was necessary to use some other fuel, and coal was generally adopted; but between the use of wood and the alteration of the fire places to receive coal, the cottagers frequently burnt bean-straw and the dried seed-stalks of turnips and other agricultural plants. The use of these for fuel has continued in Foulness until the present day.

When wood and these other vegetable substitutes were used for fuel, there was always plenty of raw material for the Potash-makers, and the diminished supply of these ashes was one of the causes of the decay of the industry.

The importance of the ashes of wood, straw, grasses, haulm, and other vegetable refuse, in the manufacture of potash, will be apparent when it is understood how large a proportion of the alkali is contained in them. Much information on this subject may be obtained from the results of analyses of the ashes of these various substances, by Messrs. J. Thomas Way and G. H. Ogston, recorded in the "Journal of the Royal Agricultural Society of England," Vol. viii., Part I.: Vol. ix., Part I.; and Vol. xi., Part II.

Putting the matter shortly and avoiding technicalities, which would not interest the general reader, it will be found that the ashes of the various plants mentioned contain from 12 to 41 parts of potash in 100, some of the grasses (as *Poa annua*) being especially rich in this principle.[3]

It would appear also from these papers that it mattered little on what soil the plants were grown, the quantity of Potash in the ash remained very nearly the same whether the soil was sandy or clayey. We must not therefore, I think, conclude, because we find so many "Potashes" in this county on Boulder-Clay, that they were established there from an idea that the vegetation was rich in alkali; the probability is, more are found on this and other heavy clays because the larger area of the county is of this character.

Another cause of the decline of the industry was the importation of a cheaper article from America. At the time our supply of wood ceased, there was an enormous area of woodland cleared in America, and potash began to be made there very cheaply from the great quantity of ashes produced by burning the branches and stems of the felled trees.

It is from America, Germany, and Russia, and other parts of the Continent, that we get our supply of Potash and Pearl-Ash—none being now produced in Britain. If there is any truth in the following report, given in the "Standard." of September 11th, 1894, it would seem that even American cheap ashes will in turn be driven out of our markets by native potash from Brunswick: "Our Berlin correspondent states that a stratum of potash, 73 metres (over 230 feet) in thickness, has been discovered at a depth of 607 metres, in the Duchy of Brunswick. This valuable find belongs to the State."

The last and most important, because the most powerful, agent in causing the decay of Potash-making in this country, was the discovery of the possibility of making Soda from common Salt; and that this was so, will appear from some of my informants' statements that "there was no soda then." Potash was used for washing linen, for the manufacture of soap, and for almost every purpose we now use soda; and it was when this last cheap detergent came into competition with potash the final deathstroke was given to a manufacture already in a very languishing condition.

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[3] Mr. John Spiller, F.C.S., whom I have again to thank for his kind assistance, has called my attention to William Nicholson's "Dictionary of Chemistry" (1795), where, under the heading "Potash," there are two and a-half pages descriptive of this manufacture in Ireland. And it is shown, "that in general weeds yield more ashes, and their ashes much more salt, than woods; and that, consequently, as to salts of the vegetable alkali kind, as pot-ash, pearl-ash, cashup, etc., neither America, Trieste, nor the northern countries have any advantage over us (Ireland)." This seems confirmatory of the analyses of Messrs. Way and Ogston, as recorded in the "Journal of the Royal Agricultural Society," quoted above.

With the assistance of the Masters of the various Union Houses throughout the county, I have made inquiries among the aged male and female inmates, and have been able to obtain much information, both with reference to the situations of the Essex "Potashes" and the work that went on therein. This information will appear below, grouped under the names of my informants, and to these gentlemen my thanks are due for the help they have so kindly given; and I have also to thank Mr. Wm. Otway, of Tolleshunt D'Arcy, for the trouble he has taken in seeing and obtaining information of a very useful kind from some old people in his district. I am also indebted to numerous other friends for facts of importance, and to whom also I beg to tender my thanks.

Personally, I only remember the two "Potashes" I have before referred to; but according to the information I have received, two others—one at Buttsbury and one at Purleigh—were finally closed about the same time.

My remembrances of these two "Potashes" are very distinct. One of them was situated near the corner in the road from Fambridge Ferry to Rochford, just where the road from Ballard's Gore falls into it. This corner was known and spoken of as "Potash Corner." The other one was on the left side of the road from Tolleshunt D'Arcy to Tollesbury, but only a short distance out of Tolleshunt D'Arcy. Both have now disappeared entirely.

The description of one will be sufficient for both, and, in fact, for the whole of the "Potashes" formerly existing, for there appears to have been a considerable family likeness in these village factories.

On the Tollesbury road, a short way out of Tolleshunt D'Arcy, was a small enclosure or field, and in this was a rough, tumbledown kind of building, covered with pantiles and having a very capacious chimney, from which, when work was going on, clouds of white smoke were always issuing. The sides of the building, which had a very home-made appearance, were formed by rough round timbers, with a covering of wattle and clay daub, and I have no doubt that these places were frequently erected by those who owned and worked in them. On going inside several large tubs were seen, some with perforated bottoms contained ashes, and others held water which had percolated through the ashes. Usually near the very large hearth was a hole in the ground formed by sinking a large tub, and this was also full of water or "lye." Surrounding the building were heaps of the materials from which the potash was made; stalks of turnips, remaining after the seed had been threshed; bean straw; pea straw, too much washed by the rain for feeding purposes; rough waste faggots; weeds, nettles and bushes from the clearings of hedgerows and ditches, called "bill draggings," by the farm labourers; and lastly, there was usually a rough heap or stack of wheat, oat, or barley straw. In fact, no woody material or vegetable fibre that would burn seemed to come amiss, and heaps of such refuse might generally be seen near the "Potash." As far as I remember, and my recollections are borne out by the evidence of some old people, the processes adopted were these: The Potash-makers visited the farm houses and cottages in the district, and purchased any wood ashes the inhabitants had for disposal. At this time, before the trade began to decay, plenty of ashes might be had, for in every farm house baking was done at home, and the brick oven which was then in use was invariably heated by a wood fire. Not only did the farmer's wife bake her own bread, but almost every cottager had an oven also, and this was heated by wood; and thus it came about that there were always plenty of ashes for sale to the potash-maker.

Occasionally, in those districts where the water happened to be very hard, there would be but few ashes for disposal, as they were used by the cottagers' wives to make the water "soft" for their weekly or fortnightly washings, as they were unable to afford soap. But if the potash-makers could purchase ashes, they were always willing to do so at a good price. I remember seeing Mr. Townsend, or his man, of the Rochford "Potash," pay about five pence a bushel for good dry wood-ashes. All the ashes bought were carried to the "Potash" and put into the tub with the perforated bottom; and on the ashes water was poured, which gradually filtered through and ran into a vat underneath, called the "lye-letch." This resulting lye was either poured into the sunken tub before mentioned or it was put into another large tub, and in it wheat, oat, or barley straw was soaked, and then this saturated straw was burned on the hearth under the large chimney, care being taken that the fire only smouldered.

As I recollect, the ashes produced by this burning were again washed, and the resulting "lye," now become very rich and strong, was again used to soak straw, which, in turn, was burnt on the hearth;

but I am not sure whether or no the process was further repeated. Some of my informants say that the process was completed in one burning. But whether at one or more burnings, I know that when finished, on raising the ashes which remained, there was seen under them on the floor of the hearth, a thick coating, several inches in depth, of a black substance, so hard as to require a pick to break it up. This mass was the "Black-potash" the workman was endeavouring to produce. When sufficient had been obtained, it was placed in casks or bags and sent to market, and from it those who carried on the manufacture further produced pearl-ashes, and other preparations of potash. Potash-making was therefore a most ingenious and economical process. They first washed all the soluble potash from the ashes and then concentrated the solution until it was deposited in a solid form, and this was accomplished by driving off the water in burning the straw saturated with the lye. Could anything be more simple and economical? Of course the water might have been evaporated by boiling the lye in a shallow boiler, but such a plan would have required a large expenditure of fuel, and consequently would have been expensive.

When I first became acquainted with the manufacture, it was dying out, as it could not compete with the greater advantages enjoyed by the makers on the Continent and in America, and in addition the cheaper soda had quite superseded it for many of the purposes for which potash was employed, and consequently the trade was almost gone, and it finally disappeared from the few places where it lingered in this county, some time about the year 1850. The last maker I knew died about 1854.

It would appear that Potash-makers were also, sometimes, Soap-boilers, and this fact explains how it is that in Poll-books of Elections held in 1741, and before that time, we find voters' names recorded as "Soap-boilers" who were living in some little country village.

In questioning some old men, they have told me some Potash-makers were also Soap-boilers, and used all the potash they made for this purpose; a statement easily understood when it is remembered that nearly all the soap of this period was Potash-Soap and not as now Soda-Soap.

All this shows that the decay of potash-making and other rural industries has inflicted a great loss on country districts, and has been one of the causes producing the depopulation of rural parishes; a fact all must be sorry for, on many grounds. Probably in a county like Essex there would have been, when this manufacture was flourishing, several hundreds of persons engaged in the trade, and obtaining their living and rearing their families, in the pure and wholesome air of the country. Instead of this, at the present time, the manufacture of Soda, which drove Potash out, is carried on in wretched crowded towns, full of every abomination, moral and physical.

The following notes are the results of inquiries made of old persons with whom I have come in contact, and also of information kindly collected, as I have mentioned before, by the Masters of the Union Houses of Essex, from aged inmates. Thus by enlarging the area of inquiry, I have been enabled to obtain some knowledge of the situation of "Potashes" in all parts of the county, and, occasionally, I have also received information of interesting facts with reference to these little factories and the work carried on in them. It was very rarely found that information could be had from any but very aged persons, and it is clear that had this inquiry been delayed for another ten years, all, or nearly all, knowledge of the industry would have disappeared.

Mr. William Otway, of Tolleshunt D'Arcy, has written me as follows: "With reference to the old 'Potash' on the Tollesbury Road, I beg to inform you, that a man by the name of James Scott carried it on for years; he died about the year 1854. There is no one living now who used to work with him, his principal helps were a woman by the name of Wade, and his grandson, both of whom are dead."

An old man, Peter Smith, aged 90, living in Tolleshunt Knights, has given me the following particulars of the "Potashes" formerly in use in that neighbourhood. They were four in number, the first three being in Tolleshunt Knights parish:

1. One on the Tudwick Road; carried on by Peter Moss.
2. One on the Kelvedon Road; carried on by George Wallace.
3. One near Oxley Hill; carried on by — Cook.
4. One in Inworth parish; carried on by — Cowling.

Peter Smith remembered the process, and thus described it, confirming my own recollections: "The method of making the Potash was this; you put a quantity of Wood Ashes in a large tub, perforated at the bottom, pour water upon the same to drain into a vat which was called the Lye-letch; after the vat was full, dip in wheat straw and place it over a slow fire of the same material, on the hearth, not allowing it to blaze, and so continue night and day until the lye and straw are exhausted or you have made what you require; it takes a quantity of wood ashes and straw. Most of the occupiers of the 'Potashes' of this district used to smuggle, and the places were used as receptacles for the Hollands, Brandy, Tobacco, etc."

Mr. F. A. King, of Bardfield, writes: "Many years ago potash was made at Bushett Farm. I remember the place standing, where they used to make it."

Dr. Thos. Taylor, of Bocking, informs me that there was a "Potash" at Hedingham, many years ago.

Mr. John Laver, of Hockley, writes: "I remember the 'Potash' at Purleigh, on the road to Cock-Larks. It was in use when I was a boy, and I have often seen the potash-man coming round to collect ashes."

Mr. R. W. Low, Master of the Ongar Union House, sends me a list of four "Potashes" in that district, from information given by aged inmates of this Union:

1. One on Ramsden Heath.
2. One on Toot Hill, near Ongar. The cottage is still called, "Potashes."
3. One near Bundish Hall, Ongar.
4. Soap House, Stondon; formerly worked by a man named Clark.

Mr. R. F. Moss, Master of the Rochford Union House, on inquiry amongst his aged inmates, could only hear of one, at "Potash Corner," Rochford, carried on by — Townsend.

Mr. C. Roydhouse, Master of the Dunmow Union House, was informed by an inmate named John Saward, aged 66 years, that he assisted, thirty years ago, in pulling down a "Potash" at Felstead, but had not been in use during his memory. Mr. Roydhouse mentions two Potashes.

1. One at the back of Pond Park, Felstead, mentioned above.
2. One at Great Bardfield, carried on by — Knights. This is the one referred to above by Mr. King.

Mr. F. Moore, Master of the Epping Union House, questioned the inmates, but none of them remembered a "Potash" anywhere, an extraordinary fact; if Potashes might have been expected to flourish anywhere in this county, one would have expected the wooded districts of the Forest to have been those especially adapted for the manufacture. The probability is, that the men questioned were not old enough to have personal recollections of the industry.

Mr. J. Nowell, Master of the Braintree Union House says: "I have questioned several of our old men as to the potash business, and some of them remember its being carried on, in the days of their boyhood (some fifty or sixty years ago), but beyond this remembrance they are not able to say much."

He sends a list of eight Potashes.

1. One on Marks Hall Estate.
2. One at Wethersfield, worked by Thomas Dace.
3. One on Tiptree Heath.
4. One on Messing Heath.
5. One at White Notley Hall; Mr. Bruce is said to have been the proprietor.
6. One at Little Leighs, Mr. Snow, proprietor.
7. One at Pattiswick Green, now known as "Potash Farm."
8. One in "Potash" Lane, Buttsbury, carried on by Mr. Porter; this was in full work about forty years ago.

Mr. Rowe, Master of Chelmsford Union House, furnishes me a list of twelve "Potashes," some of which had been previously reported to me by others:

1. Four or five "Potashes" in Great and Little Leighs, position not clearly indicated by informant.
2. One at South Hanningfield.
3. One at Buttsbury, worked by Mr. Porter.
4. One at Danbury.
5. One at Boreham.
6. One at Margaretting.
7. One at Woodham Ferris.
8. One at Sandon.
9. One at Tiptree Heath, worked by Mr. Colam.

Mr. E. Gordon-Harrington, Master of the Saffron Walden Union House, says that none of his most aged inmates remember Potash being made, but they give him the names of three localities where "Potashes" formerly existed. They are:

1. One at Ashdon Hill Farm, Ashdon.
2. One at Radwinter, "Potash Farm."
3. One at Berden, "Potash Farm."

Mr. M. P. Lockey, Master of the Tendring Union House, mentions two Potashes, and adds: "Both of these works have been given up many years."

1. One near Wix Lodge Gate, worked by Mr. Sexton.
2. One near Cann Hall, Great Clacton, worked by John Townsman.

Mr. Timperley, Master of the Maldon Union House, sends me the names of three Potashes:

1. One at North Shoebury. It was in work 72 years ago.
2. One at Little Baddow, near Potash Farm.
3. One at Purleigh, proprietor's name, Daniel Mead. It was in full work about forty years ago.

I visited the Union Houses of Lexden and Winstree and Colchester, making inquiries myself of the aged inmates, and found that many of them remembered the manufacture going on, and some had worked at it. I gathered information from them showing that it must have been a very common industry in their childhood, and especially so a few years before their time.

The first man I questioned was Charles Bond, aged 78 years; he remembered two Potashes in the Parish of Wormingford, both of them in full work in his childhood:

1. One in "Potash" Field, Rochford's Lane.
2. One in "Potash" Field, Bures Road.

Ann Smith, aged 89 years, an inmate of Lexden and Winstree Union House, said: 1. There was a "Potash" at Aldham, near the old Church; it was made with clay and covered with pantiles. 2. A Potash at Bures, carried on by a man named Bacon, but she does not remember the exact situation of it. She says Bacon used to come with a team of donkeys occasionally, and put up at Great Tey "Bells" public-house, sometimes for as much as a week at the time, whilst he was collecting ashes in the district. She was a girl at this time.

John Purkiss, aged 84 years, now an inmate of Lexden and Winstree Union said that he remembers a "Potash" at Wakes Colne Hall.

John Rogers, aged 75 years, now an inmate of Lexden and Winstree Union, lived formerly at Tiptree, said that he remembered the "Potash" near Messing Wood. He says that it was built in wattle and clay daub, and was carried on by a man named Cowling. Rogers often carried material there when a boy.

Two or three other inmates remembered the "Potash" on Pattiswick Green, which gave the name to "Potash Farm" there.

Eliza Harrington, aged 84 years, another inmate of the Lexden and Winstree Union House, remembered the "Potash" at Wethersfield mentioned in Mr. J. Nowell's list. It was down a lane near Mr. Brighton's Farm.

John Went, 84 years old, now in Colchester Union House, said: A man named Folkard, who lived near the malting on Langham Moor, used to make potash in a building close by there. Went was then a lad, but remembers Folkard going round to purchase ashes. He never saw work going on, but he has many times seen the potash going away in peck bags. Folkard would not sell it in smaller quantities, not even to oblige his neighbours.

John Laurence, aged about 70 years, an inmate of Colchester Union House, said that he formerly lived at Capel St. Mary, in Suffolk, and remembers a "Potash" at Wenham, carried on by a man named Chaplin; he knows nothing further about it, except that he was assisted in the work by his wife.

John Chisnell, aged 76, now an inmate of Colchester Union House, but who was born at Wenham, has been able to give me much information in reference to the industry, and although his statement is connected with a Suffolk "Potash," I give it here, as Wenham is but a short distance over the border, and Chisnell is one of the very few people living who ever worked in one of these manufactories, His statement is: He went to work at the "Potash" when he was seven years old, beginning work thus early because his father, an agricultural labourer, had eight children, and only earned eight shillings a week and was therefore obliged to make all do something towards the housekeeping expenses. As Chisnell began work so early and so many years have passed, he feels that he is not quite clear in all the details of the manufacture, but he well remembers that there were three large tubs, which were filled with ashes and that water was run through them all before it went into the large vat in the ground; in this vat was placed the wheat straw, which was burned after it was quite saturated with the lye; while this straw was burning on the great hearth, other straw was being put into the lye and soaked, and afterwards added to that straw already smouldering on the hearth. It was never allowed to blaze. Before they replaced the exhausted ashes, it was usual to again wash them, to remove any potash remaining, using the resulting weak lye to treat the new ashes in the tubs. He also said, that, even after the ashes had been washed, they were considered valuable for manurial purposes and were sent for by the neighbouring farmers, to put on the land.

He used to go with his master collecting ashes for some miles around, and he thinks the master paid 7d. a bushel for the best wood ashes. Ashes then were plentiful, because so little coal was burned, and in his mother's house he never saw coal burned. She had no stove, and always burned wood on the hearth. He has often seen the "black ashes" five inches thick on the hearth, after the firing was done. During the firing, when the straw was nearly burned out, they kept rounding it up with shovels until it was all consumed. He thinks the "black potash" fetched about 8d. a pound, some being sold in the district, but the greater part went to Ipswich, packed in peck bags He also added, "there was no soda then."

Thomas Moulton, aged 75, formerly living at Lexden, but now in the Colchester Union House, said: A man named Leatherdale, had a potash-works near Suttons, Fordham, but Moulton does not remember his selling any of the potash he made, as he believes Leatherdale used it all up in making soap, he being a soap-boiler, as well as a potash maker.

John Baker, aged 78 years, another inmate of Colchester Union House, said: At Bycknacre, near the Compasses, Woodham Ferris, there used to be a "Potash," but he did not know by whom it was carried on.

John Arthy, aged 85 years, an inmate of Colchester Union House, said: There was, when he was a boy, a "Potash" in the low way, just below the old Church, at Aldham. He does not know who worked it, but he remembers his cart going round for ashes.

The information given below was obtained from aged persons not in a Union House, and it may be worth recording, especially as the situation of many of the

"Potashes" is described, and reference is made to the use of the potash for soap-making.

James Wilsmore, aged 73 years, living on Malting Green, Layer de la Haye, remembers the ruins of a "Potash," in front of the Malting Farm House, on Malting Green. The corner is still known as "Potash Corner." He also remembers James Scott, who carried on the "Potash" at Tollesbury, coming round to purchase ashes, for which the price was fivepence a bushel; and his wife said she also remembered Scott telling her mother that the ashes then were of little value, as the people burned so much bean straw instead of wood.

William Curtis, aged 87 years, has lived in Layer de la Haye all his life, and remembers the ruins of a "Potash," in "Potash Field," at Layer de la Haye, just in front of the Vicarage gates, but there was no work going on in his time.

James Wood, aged 76 years, has lived in Layer de la Haye the greater part of his life, remembers an old man coming round purchasing ashes, probably the man referred to by Ann Smith. He thinks he came from Bures, driving before him eight or more donkeys with panniers on to hold the ashes.

Benjamin Munson, aged 86 years, has lived sixty years at Layer de la Haye; before that at Polstead, Suffolk, where he was born. He remembers a "Potash" on Polstead Heath, carried on by an old man named Smith, who, with his two sons, attended to it. He often saw the work going on when he went there to carry materials for burning, but he never understood the process—the great tub, holding four or five hogsheads, like a large mash tub, from its size much interested him, as did the hearth, which he describes as being nearly as large as a room. Smith would buy and carry to his Potash any weeds or rubbish, and Manson has often assisted in carrying the weeds raked off the fields in cleaning bean and pea-etches; a lot of the rubbish was what he called "Hog grass." The building was made as those were that I myself remember, the sides being wattle and clay daub, and the covering pantiles.

Manson also said "there was no soda then," the women using Potash for their washing; and he thought the introduction of cheap soda "did away with the trade."

John Moss, aged 69 years, had lived in Stanway all his life, and remembers the banks surrounding a small inclosure, with a pond in it, in the second field on Bell House Farm, as you come from Warren Lane. This is called "Potash-field," because there was a "Potash" in the inclosure, but he has no idea when it was given up. The banks were levelled and the pond filled up about forty-one years ago.

William Bacon, aged 79 years, an inmate of Winsley's Almshouses, says that he was born at Pantile Farm, Copford, and that at the adjoining farm, called Mulberry Farm, there was a "Potash." It was worked by Charles Warren, who lived in a cottage close by. The building was made with large oak studds, filled in between with sticks and clay. Warren used to go all round the district purchasing ashes, for which he paid 6d. a bushel. Bacon never paid sufficient attention to the process to become acquainted with it, although he often saw it going on. The work ceased when he was a little boy.

Bacon also remembered the remains of another Potash, on the right side of the road going from Copford to Layer Breton, between Bockenham and Beckingham Halls. This had been given up before his birth, but probably not long before.

William Smith, aged 83 years, now living at 49, Military Road, Colchester, but formerly at Earl's Colne, remembers a "Potash" at Countess Cross, in White Colne. It was worked by Samuel Manuel. There was another, opposite the

King's Head, at White Colne, and he thinks Manuel worked both. He never saw the work going on, but he remembers seeing the large tubs, which he should think would have held four or five hogsheads. There was another Potash, just before you came into Pebmarsh, but to whom it belonged he did not know. These Potash-makers used to prepare a lye, he thought, for the Soap-makers, of whom there were two or three in the district at the time he was speaking about, rather more than sixty years ago.

Mr. Townsend, now living at 7, Coverdale Street, London, but formerly at Radwinter, writes to me as follows: "When I first went to Radwinter, in 1851, a Mr. Shadrach Gowlett, on pointing out a farm to me, said it was called Potash Farm (as it is now), and that there his grandfather used to make and sell Potash I think the manufactory ceased about a century ago."

LIST OF "POTASHES" IN ESSEX.

The following list is not put forward as a complete one for Essex; to complete it would necessitate my visiting and searching in every Parish for all those inclosures or fields bearing the name of "Potash." This would entail an expenditure of more time and labour than I could afford, and, even when done, would only show how extensively this industry prevailed. This is undoubtedly an interesting fact, but probably the following list, giving examples of "Potashes" formerly existing in many parts of the county will be considered sufficient to make it clear that potash-making was a general industry spread over the county. If it serves no other useful purpose, it will give an opportunity for those of the present generation, who do not know the meaning of the name "Potash Field," to understand why the term was applied to so many spots.

For convenience of reference, the names of those Parishes where "Potashes" existed will be placed alphabetically, and where it has been possible to ascertain the names of the proprietors of the works, these have been added:

Aldham, near the old Church.
Ashdon, on Hill Farm.
Baddow, Little, near Potash Farm.
Bardfield, on Bushett's Farm. Proprietor, Knighton.
Berden. Potash Farm.
Billericay. Potash Field, near Norsey Wood.
Boreham.
Bures (which Bures is uncertain). Proprietor, Bacon.
Buttsbury, in Potash Lane. Proprietor, Mr. Porter.
Clacton, Great, near Cann Hall.
Colchester, on Parsons Heath. Proprietor, Folkard.
Colne, Wakes, near Old Hall.

Colne, *White*, near Countess Cross. Proprietor, Samuel Manuel.
„ opposite King's Head. „ „
Copford. Mulberry Farm. Proprietor, Mr. Phillips.
„ near Bockingham Hall.
Danbury, at Potash Farm. (*See Sandon*.)
Felstead, back of Pond Park.
Fordham, near Suttons. Proprietor, Mr. Leatherdale, a Soap-boiler also.
Hanningfield, *South*.
Hedingham.
Inworth. Proprietor, Mr. Cowling.
Langham, on the Moor. Proprietor, Mr. Folkard.
Layer de la Haye. at Potash Corner, Malting Green.
„ „ in Potash Field, opposite the Vicarage.
Leighs, *Great and Little*. Four Potashes. Proprietor of one in Little Leighs, Mr. Snow.
Margaretting. Locality not given.
Marks Hall, on the Honywood Estate.
Messing, on the Maldon Road. Proprietor, Mr. Cowling.
Notley, *White*, on the Hall Farm.
Ongar, *Chipping*, the Potashes Toot's Hill.
„ near Bundishes Hall.
Purleigh, near Cock Larks. Proprietor, Daniel Mead.
Pattiswick, at Potash Farm.
Pebmarsh, on the White Colne Road.
Polstead (Suffolk). on Heath. Proprietor, Smith.
Radwinter, at Potash Farm. Proprietor, S. Gowlett.
„ The Potash, public-house.
Ramsden Heath, on the Heath.
Rochford, at Potash Corner. Proprietor, Townsend.
„ at Potash Wood.
Sandon, Potash Farm, sometimes said to be in Danbury.
Shoebury, *North*.
Stanway, in Potash Field, on Bell House Farm.
Stondon, at the Soap House. Proprietor, Clark.
Tiptree Heath, on Heath. Proprietor, Colam. May be the same as Messing.
Tolleshunt D'Arcy, on Tollesbury Road. Proprietor, James Scott.
Tolleshunt Knights, on Tudwick Road. Proprietor, Peter Moss.
„ on Kelvedon Road. Proprietor, George Wallace.
„ near Oxley Hill. Proprietor, Cook.
Wenham (Suffolk). Proprietor, Chaplin.
Wethersfield and Codham. Proprietor, Thos. Dace.
Wix, near the Lodge Gate. Proprietor, Sexton.
Woodham Ferris, near Compasses.
Wormingford, near Rochfords, in Potash Field.
„ on Mount Bures Road, in Potash Field.

THE BATS OF EPPING FOREST.

By the late EDWARD NEWMAN, F.L.S., F.Z.S.

IN the 1874 edition of Mr. Henry Walker's excellent little "Saturday Half-holiday Guide," to which many of us look back with pleasure, mingled with regret at its discontinuance, appeared a short paper by the late editor of "The Zoologist," on the Bats frequenting the Forest. As the "Guide" has been long out of print, and as so little has since been published on the Vertebrate Fauna of the Forest, it may be useful to give a condensed account of Mr. Newman's interesting observations, in illustration of which a set of the seven species of Bats mentioned will shortly be placed in the Forest Museum at Chingford. The names employed are those of the Second Edition of Bell's "British Quadrupeds."

"EPPING FOREST swarms with bats. They crowd by day into the hollow hornbeams, they creep into the faggot stacks, they hide in the piles of wood and in the roofs of cottages—where cottages of the right sort are left—crawling in through little holes that have served generations of sparrows and starlings as conduits to their nesting places under the tiles, sometimes, but very seldom, hiding in a crevice of rugged bark, a situation they cannot be said to *select*, but may be supposed rather to *adopt* by force of circumstances. Having delayed their return from nocturnal rambles a little too long, and so being overtaken by the slanting, searching rays of a summer morning's sun, they have hastily adopted the axiom of 'any port in a storm.'

"In these various retreats they slumber all day long, having first hung themselves up by the toe-nails, head downwards, and having folded their sable shawls gracefully around them.

* * * * * *

"No sooner do the shades of evening fall on the Forest and the stars begin to twinkle, than the bats unhook themselves and unfold their shawls and take themselves down, as it were, and launch themselves into the delicious air of a summer's evening, seeming determined not to return home until morning, when daylight shall again appear, and in the meantime, to make a regular night of it.

"Now, if you wish for specimens, it is of no kind of use to shoot them on the wing, as some have attempted to do. I will not say that it is impossible to hit them, but it is impossible to find them; they fall into the thick brushwood, and are seen no more. The right way to obtain bats is to search diligently by day in their hiding-places, or, if nocturnal pursuits have any charm for you, to fish for them with a rod and line; a common fishing-rod, or even a hazel wand, will do very well. The line must be a short piece of string, and the bait a head of burdock, previously prepared by dipping in whitewash and drying by the fire. The bat mistakes this for a moth, dashes at it, clutches it in his arms, and the little hooks of the burdock fasten in his wings and render him a helpless, hopeless prisoner."

Mr. Newman enumerates seven species of Cheiroptera as occurring in the Forest, all belonging to the family:

Vespertilionidæ.

1. Scotophilus Noctula. The Noctule or Great Bat.

The *Noctule* is the largest of all, the boldest, the highest flyer; it is the swift among bats. Sometimes a party of six or seven will fly in company, squeaking or chirping so loud and distinctly that you may hear them coming when yet a hundred yards away. Sometimes the Noctule flies so high that one wonders what it finds to eat up in the sky hawking about, as though insects would be silly enough to fly up there only to be eaten by bats. Sometimes it dashes up and down the main street of Epping quite low, as though its prey was also keeping near the ground. Sometimes—but this is confined to May and June—it will continue flying round the taller trees in search of cockchafers, the big chafer in May and the little one in June; and this diet is varied in autumn and early spring by an occasional dor-beetle.

Every now and then, even in its most rapid flight, the Noctule will seem to tumble head-over-heels, throwing a kind of somersault in the air like a tumbler pigeon. Some have supposed that at every tumble it catches a cockchafer, and stops to stuff the captive into its mouth; but if this is really the case, its consumption of cockchafers must be prodigious and its digestion amazingly rapid. I have often observed the wing-cases of cockchafers and dor-beetles on the ground under the trees, and have given the Noctules full credit for eating the bodies. The Noctule seldom reposes by day in human habitations, but betakes itself to hollow trees, and is very fond of company. Mr. Bond saw sixty-nine Noctules routed out of one hollow tree, and in the bright sunshine, too; and they did not seem offended at this unceremonious treatment, but, after taking a few rounds, flew off to some more secure place of rest.

It is rather curious that all the Noctules found in one tree are of one sex, all males or all females, and, on more than one occasion, on finding one of these congregations of females, every bat has had a baby-bat in her arms. Noctules have only one young one at a time, and they always carry it until able to shift for itself. The baby-bats hang on to their mother in front.

2. Scotophilus Pipistrellus. The Pipistrelle or Common Bat.

The *Pipistrelle* is the smallest and commonest of our bats, and differs from the others in two points—first, it does not seem to require a season of torpidity, flying during every month in the year, although more commonly in summer; and secondly, it is very frequently seen flying by day, even in the brightest and hottest sunshine. Like the martins and swallows it feeds on all manner of flying insects; and as two of a trade never can agree, it is teased and tormented, and mobbed whenever the swallows and martins catch it in the act of poaching on their hunting-grounds, for they evidently regard this as a decided encroachment on their manorial rights, and therefore consider it a duty to keep on stabbing him with their little beaks until they force him to beat a retreat from the realms of air, and take refuge nearer earth.

3. Vespertilio Nattereri. Natterer's Bat, or the Reddish-Grey Bat.

Natterer's Bat is not uncommon in the Forest, but has not been found in hollow trees. It frequents old buildings by day, and uses the Forest only as a hunting-ground. Workmen repairing old houses that have long been tenantless now and then find a Natterer's Bat hanging from the underside of the tiles, and are quite at a loss to conjecture how it came there; and yet it is not difficult to believe that a bat might easily squeeze its body through a very small aperture. Mr. Doubleday, the great Epping Naturalist, calls my attention to the colour of this bat, which is much paler than that of any other British species. It is pale yellowish brown on the back, and silvery white on the belly; the wing membranes are also very pale. We may be pretty sure that it feeds on high-flying moths, as Mr. Doubleday on one occasion took a specimen in his insect-net when mothing.

Publications of the Essex Field Club.—*Contd.*

ESSEX FIELD CLUB, SPECIAL MEMOIRS, VOL. I.

"REPORT ON THE EAST ANGLIAN EARTHQUAKE OF APRIL 22ND, 1884."

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ESSEX FIELD CLUB, SPECIAL MEMOIRS, VOL. II.

"THE BIRDS OF ESSEX:

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Members and friends are reminded that the EPPING FOREST MUSEUM, Queen Elizabeth's Lodge, Chingford, is NOW OPEN (free) DAILY from 10 a.m. to 4 p.m. The Museum is intended to illustrate the Natural History, Geology, Topography, and Antiquities of the old Waltham Forest district, as defined by the Perambulation of 1641 (17th of Charles I.).

THE JOURNAL OF MALACOLOGY

(Established by WALTER E. COLLINGE in 1890 as "The Conchologist, a Journal of Malacology.")

EDITED BY

WILFRED MARK WEBB, F.L.S., Technical Laboratories, County of Essex.

With the assistance in special departments of:—The Rev. A. H. COOKE, M.A., F.Z.S., King's College, Cambridge.—Lieut.-Col. H. H. GODWIN-AUSTEN, F.R.S., Godalming.—CHARLES HEDLEY, F.L.S., Australian Museum, Sydney, N.S.W.—S. PACE, Royal College of Science.—E. R. SYKES, B.A., F.Z.S., London.—B. B. WOODWARD, F.L.S., F.G.S., British Museum.

"*The Journal of Malacology*" is an Illustrated Quarterly Review which deals with *all branches* of the study of *the Mollusca*. The Bibliography of Current Literature is still a special feature of the publication.

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The
Essex Naturalist:

BEING THE

JOURNAL

OF THE

ESSEX FIELD CLUB.

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.
Honorary Secretary and Curator.

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COMMUNICATIONS *and* **ADVERTISEMENTS** *should be addressed:—*
The Editor of "THE ESSEX NATURALIST,"
7, Knighton Villas, Buckhurst Hill, Essex.

COMMUNICATIONS FOR "THE ESSEX NATURALIST."

AN EDITORIAL APPEAL.

Some few years ago, I printed an appeal to the readers of THE ESSEX NATURALIST to interest themselves in its welfare, and to aid me in the difficult task of editing by sending contributions. I am sorry to say that this request led to but scant response. As we are now approaching the end of another year, I venture again to call upon our friends and members for such aid, in the hope that it will be more freely and systematically rendered during the coming sessions.

No one can more regret than I do, the occasional delays in the publication of our journal, arising in great measure from the pressure of work in other departments of the Club's activities, but I humbly suggest that those who criticise should be prepared to season their remarks with a little *help*; if a more regular supply of Papers and Notes were sent in, one of my great difficulties and a main source of delay would disappear. *With the present part all the papers actually ready for publication are printed*, and the Editor stands, like Oliver, "asking for more." It is desired to issue another part at the end of the year to finish off Vol. IX., for which two papers are already promised, but of course there will be space for others—*Bis dat qui cito dat.*

Every reader could with but little trouble render most welcome assistance. Not only are longer and more important memoirs desired, but the greatest aid would be given by the communication of SHORT PAPERS, NOTES, and of books, periodicals, newspapers, etc. (*or extracts from the same*), containing matter (reports, captures, natural history, antiquarian or other "finds," topographical descriptions, news of the exposure of geological sections, etc.) likely to be useful for THE NATURALIST or for the information of the Council and officers.

Further, as the Winter Session will soon commence, PAPERS and EXHIBITS for the MEETINGS are greatly desired, and I shall be glad to hear from those having such in preparation.

[It would greatly assist if exhibitors of objects at meetings would themselves prepare short descriptions of them for publication, and hand the same to me *at the meetings*.]

I hope that the members, thus appealed to, will exert themselves to aid the officers in carrying on the work of the Club in accordance with the objects for which it was founded. They should hold themselves responsible, in some measure, for the progress of the Club, and look upon themselves as a band of "enthusiasts" gathered together for the study and investigation of the natural history of Essex. The Journal should be used for recording observations origina and selected on these subjects, and as a medium of intercommunication between lovers of natural science dwelling in, or having a friendly regard for, our interesting county.

WILLIAM COLE,
Hon. Secretary and Editor.

Buckhurst Hill,
October 20th, 1895.

4. Vespertilio Daubentonii. Daubenton's Bat.

Daubenton's Bat is another apparent rarity, but this is rather owing to our not being acquainted with its manners and customs. It feeds on those flies which everybody must have observed wandering over ponds and rivers at eventide; and as these little creatures have indulged this taste from time immemorial for some purpose of love-making or egg-laying, or eating or drinking, and never seem to cease from motion, so these bats restrict their predatory excursions to the surface of the water, almost touching it with their wings, and often quite touching it with their mouths. In flying over water this bat passes so very, very near the surface, that it could not fail to wet its wings were it not for the peculiarity of its flight. In this it seems to imitate one of the heavy-bodied, slow-flying hawk moths. The vibrations of its wings are very fast, but the progress made is very slow; it seems to pass over the water in curves, rather by a feeble silent buzzing than by vigorous flight. Notwithstanding this turn for aquatic life, Daubenton's Bat has been known to roost at a considerable elevation, having been found in the tower of the church at Stratford-on-Avon; but at Epping it seems to confine its excursions to the little ponds in the Forest.

5. Vespertilio Mystacinus. The Whiskered Bat.

The *Whiskered Bat* is very rare, and, as far as I know, only two specimens have been taken at Epping; both of them, like our aged paupers, were found taking refuge in the union workhouse. This bat seems to lead a secluded and somewhat ascetic life, never or very rarely being found in company with others of its kind. It hunts its prey under the lee of a hedge-row, and very rarely flies so high as the top of a tree.

6. Plecotus Auritus. The Long-eared Bat.

The *Long-eared Bat* is remarkable, not merely among bats, but among all animals, for the exquisite beauty and great size of its semi-transparent ears, which are as long as its body, and broad in proportion to their length. Just think of a cat having such ears, or a cow, or a pig! And yet such is the symmetry aud elegance of this little bat, that no one notices its ears as a defect, or as detracting one iota from the beauty of its appearance.

This little bat is exceedingly common, and most easily tamed. It sleeps by day in human habitations, preferring old and dilapidated buildings to more recent or more showy erections. Mr. Doubleday once found more than a hundred in an old garret.

In a state of nature it prefers moths to all other insects, and, like entomologists of larger growth, is particularly addicted to mothing at the sallows; these are in full blossom in March, and the golden catkins are as attractive to the Long-eared Bats as to the various species of moths, for whose especial benefit they seem to have been provided at that flowerless season of the year. The moths feed on the catkins; the bats feast on the moths.

The bats pick off the moths one by one as they sit complacently imbibing the nectar. But it is not only the catkin-feeding moths that become the prey of the Long-eared Bat, the very smallest moths—those we call *Microlepidoptera*—are equally to his taste; and it seems strange how he can possibly make a meal of these minims of creation. Yet, so it is; these Micro's, wearied of their nocturnal gambols, settle on the leaves at the approach of day, and compose themselves to rest, vainly trusting to what appears the repose of universal nature. Alas! it is a vain delusion. The bat has been up and out all night, and has not yet retired for the day. He flutters round the flowery bush, and picks off the living gems one by one, until the coming sun warns him to withdraw.

7. **Barbastellus Daubentonii.** The Barbastelle Bat.

The *Barbastelle* does not appear to be very rare, but certainly is very difficult to find. It never turns out until nearly dark, and then flies very low, never, or very rarely, showing itself between the spectator and the sky. Add to these peculiarities in the time and manner of flying, that it is almost entirely black, and we can scarcely wonder that it has been so seldom noticed. In the daytime it takes a *siesta* in one or other of the numerous stacks of wood or faggots which are to be seen in the Forest, more particularly by the side of the Forest roads.

The Barbastelle, when once in the hand, is easily distinguished by the peculiarity of the ears, which rise from the forehead side by side, actually touching one another, and seem to be united at the base.

STRAY NOTES ON ESSEX.

From the "Gentleman's Magazine Library."[1]

I NEED hardly remark that the "Gentleman's Magazine Library" consists of a classified collection of the chief contents of the "Gentleman's Magazine" from 1731 to 1868, and is edited by Mr. G. L. Gomme, F.S.A. The volume here noticed consists of 353 8vo pages, of which 157 are devoted to Essex. References are also given to articles on Essex subjects which have appeared in other volumes of the series, such as those on prehistoric antiquities, folk-lore, etc.

On the whole, the matters touched upon in this volume are of interest rather to members of the Essex Archæological Society than to those of the Essex Field Club. But there is much to attract the attention of those who are devoid of any specially archæological tastes. Among Essex names of places is *Ugley*. Of this we learn from Mr. J. H. Sperling (1858), that the singular name of this village "proved so distasteful to the vicars of Ugley, that they have made several attempts to get the name changed to Oakley, which they contend is original and correct." This view is in all probability the right one, and as we can only suppose the corrupt name to have been affixed by the residents in the neighbouring villages, it seems a hard thing that the vicars should have been unsuccessful; for "Ugley" appears on the newest ordnance maps.

In THE ESSEX NATURALIST, vol. iii., pp. 27-35 (1889), appears a paper by Mr. H. Laver, styled "Fifty Years Ago in Essex." Among other matters, Mr. Laver touches upon the prevalence of ague in certain parts of Essex in the sixteenth and seventeenth centuries, and its rarity at the present day. In this volume of the "Gentleman's Magazine Library" there is a short account of Fobbing, the date of the communication being 1829. The writer remarks that although Fobbing "stands upon a high hill, the ague is very prevalent there. The population of this parish is about 450, many of whom are carried away every year by the above-mentioned malady. . . . There are several farms scattered over the marshes, of which there is a great abundance: to these marshes the ague is principally attributed." Some remarks about Southend are dated 1812. The writer states that "towards the latter end of autumn the interior of this hundred is subject to the ague, but the immediate coast is not liable to this unwelcome guest, but is even the winter's asylum of the more opulent of the neighbouring residents of Rochford and its nearer vicinity." We learn that Southend was not known as a bathing place forty years before 1812, that the bathing was good, but dependent on the state of the tide, and that the warm baths "though confined in accommodation, are not objectionable, otherwise than the attendants do not abound in official assiduity." Also that "the company of this place chiefly consists of families who live in the contiguous part of the country, and of those who migrate for a short time from the metropolis." In an earlier account of Southend (1794) we have a description of the septaria nodules in the cliffs, and we learn that daily coaches go to London, and that "a regular post of four days in the week has been appointed by the Postmaster General."

Under the heading "Hainault Forest," we have a description of the celebrated Fairlop Oak as it appeared in 1793 and in 1806. And there are details, written in 1802, of another huge oak at Hemstead.

---

[1] "The Gentleman's Magazine Library," English Topography, Part IV. (Durham, Essex, Gloucestershire). Eliot Stock, 1893.

There is an account, dated 1791, of the sinking of a deep well at East Hanningfield parsonage, which, as it is not mentioned by Mr. Whitaker ("Geology of London and Part of the Thames Valley") may be usefully given here:

"It was begun June 21, 1790, and water, when the workmen, from such tedious labour, were at the moment of despair, was found May 7th, 1791. Thirty-nine thousand five hundred bricks were used, without cement, in lining this well, the soil of which, for the first 30 ft. was a fine, light brown, imperfect marl; and though fossilists may ingeniously choose to discriminate the different strata, yet, except from shades of a deeper colour and firmer texture, occasionally, but slightly, mixed with a little sand and a few shells, the same soil, to a common eye, without more material variation, continued to 450 ft., where it was consolidated into so rocky a substance as to require the being broken through with the mattock. A bore then of 3 inches diameter and 15 feet in length, was tried, which soon, through a soft soil, slipped from the workman's hands and fell up to the handle. Water instantly appeared, and rose within the first hour 150 feet, and, after a very gradual rise, now stands at 347 feet, extremely soft and well flavoured. This source is supposed to supply the well at Battle's Bridge, about six miles further, and lower than Hanningfield, which is 336 feet in depth, and the water overflows the brim. At Bicknacre Priory, 1¼ miles in descent from Hanningfield, is a well (nearly through neglect choked up) only 4 feet in depth."

It would appear from the details given that the London Clay was pierced through, and water obtained from sandy beds beneath, belonging to the Woolwich and Reading series. It is possible that the "fine light brown, imperfect marl" at the surface was the Boulder Clay, but if so, it is strange that the difference between it and the underlying London Clay escaped notice even from the "common eye" of the narrator. The rocky substance at a depth of 450 feet may have been at the base of the London Clay. A glance at the map of the Geological Survey shows East Hanningfield standing partly on London Clay, partly on Boulder Clay, so that the nature of the surface rock at the well remains uncertain. And there can be little doubt that the well at Battle's Bridge, which is from 40 to 50 feet above ordnance datum, while East Hanningfield is from 180 to 200 feet, is supplied from the same source. The height of the surface at Bicknacre Priory is about 150 feet.

A correspondent, writing in 1796, about Netteswell, near Harlow, gives the following account of the fossils:

"Here are found in the gravel-pits, nigh the Cross, belemnites of a chocolate colour, radiated from a close centre. Also, in the gravel pits nigh the church, the *Echinites galeatæ* of Birkenhout, and in the ploughed land are found the cordiformed echini, called by Brookes *Brontiæ*.

"The *Oculatus lapis*, or pudding-stone, is likewise not uncommon here, and is called by the inhabitants the "breeding stone." There is one of an immense size near the Bury, the lower part of which is not so compactly conglutinated as the upper. The cement is of a white colour, and the pebbles of which it is composed are chiefly small flints."

A writer about Epping, in 1806, greatly admires the thick ivy covering the north side of the tower, "where the loquacious sparrow nestles in security, the clamorous inhabitant of deserted castles hides his powdery pate, and the dappled starling serenades his sitting mate." He also notes, from the dates on the gravestones, that many of the inhabitants attained to very advanced ages, and finds that a large number of old people were then living in the town, among them two each aged more than 100 years. Another correspondent of "The Gentleman's

Magazine," writing in 1799, gives a list of aged persons buried at High Easter, two of whom were 97 years old at the time of their decease. Under the heading *Danbury*, a Mr. T. White, writing in 1789, describes the opening of a leaden coffin under the north aisle of the church there in 1779. It was supposed to contain the remains of a Knight Templar. The lead coffin enclosed an elm coffin, in which was a shell. He adds:

"The lid of this shell being carefully taken off, we were presented with a view of the body, lying in a liquor or pickle, somewhat resembling mushroom catchup, but of a paler complexion, and somewhat thicker consistence. As I never possessed the sense of smelling, and was willing to ascertain the flavour of the liquor, I tasted, and found it to be aromatic, though not very pungent, partaking of the taste of catchup and of the pickle of Spanish olives."

It would be out of place to dwell, in THE ESSEX NATURALIST, on the purely archæological aspects of this investigation. But the unique form in which the courage of this fearless explorer was shown, in the performance of a deed from which most wearers of the Victoria Cross nowadays would probably shrink, makes his act one which all members of the Essex Field Club will read of with interest and wonder.

T. V. HOLMES.

THE ESSEX FIELD CLUB.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31ST, 1895.

[*Read and adopted at the 16th Annual Meeting held at Stratford, March 28th, 1896.*]

THE principal Club event of the past year was the establishment and opening of the Epping Forest Museum, concerning the origin and progress of which, as well as of the work at the Central Museum, separate Reports are presented. (See pp. 145-46.) Other matters have gone on much as usual, and this, the 16th Annual Report, need not be of a lengthy or elaborate character. As was the case at the last two Annual Meetings, several important matters (such as the roll of members and the state of the subscription list) are still in abeyance, but the Council is now taking decided measures to put an end to the unsatisfactory state of the finances of the Club, even at the risk of losing some old nominal members.

FINANCIAL.—The general income of the Club shows a falling off to the extent of some £28, when compared with the previous year, due partly to the defection of a number of the old Chelmsford Museum members, and partly to a diminished yield from "arrears." The financial position, however, is stronger than it has been for several years, owing to a substantial decrease of expenditure having been effected in the face of considerable difficulties. One Life Composition of £10 10s. has been received since last Report, and the two Museum Funds have been practically exhausted.

Subsequent to the closing of the present Balance Sheet, a Sub-Committee of the Council was appointed to deal with subscriptions in arrears. The Committee is not yet in a position to present a final report, but it is understood that, so far, about £30 has been got in as the result of this special effort. The Council hopes that by the end of the current year a material reduction will be apparent in the adverse balance of £73 16s. 2d. which now exists on General Account, and that, when this has been finally liquidated, some means may be devised for getting rid of the £33 12s. 4d. which represents the residue of loss incurred by special publications.

In connection with the finances of the Club, the Council cannot allow Mr. Lockyer to vacate the position of Treasurer, which he has so worthily occupied for a very considerable period, without expressing on its own behalf, and on behalf of the members of the Club generally, the grateful thanks of the Society for the great trouble and care he has taken in keeping our very complicated accounts in an admirably clear and skilful manner, and for the energy he has displayed in the unpleasant, and oftentimes unprofitable, task of collecting subscriptions. Mr. Lockyer is one of the very oldest members of the Club. He is one of the two gentlemen who answered Mr. Cole's letter in the "Woodford Times," of October 25th, 1879, in which the establishment of the Club was proposed. Mr. Lockyer took the office of Librarian in January, 1881, and held it for five years, until the end of 1885; and it is no disparagement to his successors to say that never was the library in better case than during his years of office. And not only did he arrange a useful system of exchange with other Societies, but he gave the Editor most valuable assistance in the production of the Journal of the Club, aid which has been much missed since his retirement from the Librarianship. Mr. Lockyer took the office of Treasurer in January, 1889, and he has consequently served in that capacity for over seven years, making in all twelve years' work as an Officer of the Club.

Mr. W. C. Waller, M.A., F.S.A., a gentleman who has taken great interest in the Club as one of the Librarians, has kindly consented to take the Treasurership, at least for a time, and the Council has great pleasure in recommending him for the office.

MEETINGS IN 1895.—Ten meetings have been held during the past year, in the conduct of which the Secretary has received most welcome co-operation from several members of the Club and others. On January 12th Prof. Charles Stewart, F.R.S., gave an interesting lecture entitled "Stray Notes on Natural History." At the meeting of the Club at the Museum and Library of the Corporation of London, on February 16th, the members were most kindly received and entertained by Mr. and Mrs. J. Douglass Mathews (Chairman of the Library and Museum Committee), and by Mr. Charles Welch, the Librarian and Curator. Sir William Flower received the members at the British Museum of Natural History on April 6th, and gave one of his admirable addresses on the plan of arrangement of his magnificent "Index" or "Introductory" Museum, and on several interesting biological problems suggested by these collections. At the Field Meeting in Epping Forest, on May 8th, 1895, Mr. E. N. Buxton gave most valuable assistance as "Conductor," and in other ways made the success of the meeting assured. At the meeting at Ongar Park Woods on June 15th, the members were most kindly and hospitably welcomed by Mr. and Mrs. W. S. Chisenhale-Marsh, at their beautiful residence at Gaynes Park. Our kind friend, Major Lamorock Flower, again conducted and arranged, in conjunction with Mr. Walter Crouch, Mr. H. A. Cole, and the Secretary, an excursion on the River Lea, this time from Bromley to Waltham Abbey, and we have to thank the Lee Conservancy Board for again lending their steam barge, *The Salisbury*, and for in many ways facilitating the excursion. We have also to thank Colonel Bryan for

Dr. TREASURER'S STATEMENT OF INCOME AND EXPENDITURE FOR YEAR ENDED 31ST DECEMBER, 1895. *Cr.*

GENERAL ACCOUNT.

	£ s. d.	£ s. d.		£ s. d.
To Subscriptions, 1892	2 0 6		By Balance from 1894 (excess of Payments over Receipts)	95 14 11
,, ,, 1893	8 2 0		,, Printing and Illustrating "Essex Naturalist	61 19 8
,, ,, 1894	20 17 0		,, General Printing, Stationery, and Binding	5 13 3
,, ,, 1895	131 5 0		,, Postage of "Essex Naturalist," Circulars, Officers' Correspondence, etc.	22 0 1
,, ,, 1896	5 15 6		,, Incidental Expenses	7 14 9
		168 0 0	,, Rent of Central Museum Premises	25 0 0
,, ,, Forest Museum (Maintenance)		6 3 6	,, ,, Cottage at Chelmsford	5 10 3
,, Entrance Fees		7 17 6	,, Salary of Sub-Curator (Mr. Mothersole)	18 10 0
,, Donations		1 16 6	,, Fire Insurance and Gas	3 17 5
,, Profit on Field Meetings		1 7 3	,, Removal Expenses from Buckhurst Hill to Chelmsford.	5 10 6
,, Balance (excess of Payments over Receipts)		73 16 2	,, Purchase of Books, etc.	2 5 1
			,, Fees to Lecturers, etc.	3 13 6
			,, Hire of Meeting Rooms	1 11 6
		£259 0 11		£259 0 11

LIFE COMPOSITION ACCOUNT.

	£ s. d.		£ s. d.
To Balance from 1894	104 10 6	By Balance to 1896	115 0 6
,, One Life Subscription, 1895	10 10 0		
	£115 0 6		£115 0 6

SPECIAL MEMOIRS PUBLICATION ACCOUNT.

	£ s. d.		£ s. d.
To Sales of Publications	0 6 0	By Balance from 1894 (excess of Payments over Receipts)	33 18 4
,, Balance (excess of Payments over Receipts)	33 12 4		
	£33 18 4		£33 18 4

CENTRAL MUSEUM FUND.

	£ s. d.		£ s. d.
To Balance from 1894	25 14 7	By Sundry Fittings, Jars, Chemicals, etc., etc.	29 13 11
,, Donation paid, 1895	10 0 0	,, Balance in hand	6 0 8
	£35 14 7		£35 14 7

FOREST MUSEUM FUND.

	£ s. d.		£ s. d.
To Balance from 1894	55 6 11	By Cases	44 10 6
,, Donations paid, 1895	40 0 0	,, Materials for ditto	5 2 11
		,, Sundry Fittings, Jars, Boxes, and other Museum fittings	34 11 2
		,, Ward & Co. for Stuffing Specimens	3 7 9
		,, Balance in hand	7 14 7
	£95 6 11		£95 6 11

N.B.—*It should be noted that the Club possesses very large assets in books, specimens, cabinets, stock of publications, etc., which although valuable cannot easily be estimated accurately.*

Examined with Books and Vouchers and found correct,

A[illegible]

WALTER CROUCH, } *Auditors.*
JOHN D. COOPER, }

his kind reception of the party on this occasion at the East London Waterworks at Lea Bridge. Dr. Cooke and Mr. A. B. Rendle gave most valuable aid at the Fungus Foray on October 19th; and at the opening of the Forest Museum, we have to particularly thank Mr. R. C. Halse, Mr. E. N. Buxton, Mr. F. McKenzie, and Mr. A. Smith Woodward for their assistance in making the ceremony a success. At this meeting our President kindly undertook the charges for the numerous invited guests, and so enabled the Secretary to arrange the details of the meeting at a minimum expense to the Club. It should also not be forgotten that Mr. Butler kindly gave the use of his room for the reception of the Epping Forest Committee, and provided materials and assistance for suitably fitting up the same. We have also to thank, in connection with the above meetings, Professor Meldola, Professor Boulger, and Mr. Walter Crouch for valuable aid afforded in the conduct or arrangement of the same.

MEMOIRS AND PUBLICATIONS.—The papers read have been far less numerous than in some previous years, and the Council would urge members to keep up the scientific credit of the Club by contributing papers and notes. THE ESSEX NATURALIST has been greatly delayed owing to several causes, and little can be said concerning it until some satisfactory mode of publication and systematic aid to the Secretary as Editor can be established. The matter is now commanding the attention of the Council, and will be reported on later. The Council have to thank Mr. E. T. Newton, F.R.S., and Mr. T. V. Holmes for much scientific assistance in determining specimens and surveying sections, and Prof. Meldola for defraying the cost of engraving five illustrations in his paper on the "Eastern Boundary Stones of the Forest of Waltham." Our thanks are also again due to Mr. H. A. Cole for the very numerous drawings he has contributed, free of cost, in illustration of the circulars and publications of the Club. The issue of the first two "Guides" to the Epping Forest Museum is alluded to in a separate report.

PROTECTION OF WILD BIRDS IN THE COUNTY.—The Club's action in this matter, and the formation of Mr. Buxton's Epping Forest Bird Protection League, is recorded in THE ESSEX NATURALIST. The Council has been considering the desirability of appointing a Committee to take action in connection with the order of the Secretary of State for the protection of coast birds, but there were several difficulties in the Club undertaking such a work, and the necessity has been obviated by the establishment of a small society for that end, of which our esteemed members, Mr. E. N. Buxton and Mr. Champion Russell, are respectively President and Secretary.

DEATH OF MR. CHARLES BROWNE.—The Council much regret to record the death of Mr. Charles Browne, M.A., F.S.A., Barrister-at-law, and Hon. Counsel to the Club, which took place on the 1st of November last. Mr. Browne took great interest in the Club, and was one of the first Hon. Members, having been elected on January 10th, 1880, in acknowledgment of his services in settling the Draft Rules of the Club submitted to him by Mr. Cole. Mr. Browne's services have been most valuable as legal adviser to the Council; he settled the last edition of the Rules, and was always willing to aid in any way in his power.

The Council is glad to say that Mr. W. C. Dare, B.A., Barrister-at-law, who has succeeded to Mr. Browne's chambers, has kindly consented to act as *Hon. Counsel* to the Club.

The Council are sure that the members generally will endorse most heartily their recommendation that Mr. David Howard should be re-elected to the Presidential Chair.

INTERIM REPORT ON THE CENTRAL MUSEUM.

[*Presented by the Hon. Curator to Annual Meeting, March 28th, 1896.*]

I BEG to report that, as far as my time and that of Mr. Mothersole would allow, work has been carried on steadily during the year. Nearly every specimen in the old Museum has been overhauled and examined. The specimens stored in the cottage hired for the purpose have been roughly sorted, and are now ready for a decision to be come to as to those things which should be rejected as unsuitable for our purpose, and those which should be retained.

Since the last Report some very interesting DONATIONS have been made:

The Rev. A. W. Rowe, now of Lincoln, but formerly head-master of Felstead School, has presented a collection of about twenty worked flints, mostly from Felstead or its neighbourhood.

Mr. Reginald Christy has presented a set of Bats from his own neighbourhood, Roxwell.

Miss Dixon has presented a very fine Wasps' nest, and *Mrs. Leemann* and *Mr. Bentall* some fossils, which will be useful in the compilation of our proposed educational geological series.

Mr. Graham has sent some pieces of the Core obtained during the experimental boring for coal at Stutton, being one of the three sets of specimens preserved. The other two have been sent to Cambridge University Museum and to the Ipswich Museum.

Mr. Mothersole has presented about sixty species of Crag Fossils from Walton-on-the-Naze.

The *Rev. W. J. Kenworthy* has *lent*, for a limited period, a series of Essex Flint Implements from his collection, and I have reason to believe that other gentlemen will either lend or give such specimens.

Glass has been fitted to the two geological cabinets containing the Carvalho and Hope Collections, and new trays fitted where necessary. A commencement has been made in arranging the Crag Fossil Collections in glass-topped boxes.

Dr. Laver's various collections (alluded to in last year's Report) have been received, and they form a most valuable addition to the Museum. The Bats have been mounted in jars in alcohol and on stands, and a commencement has been made in arranging the Land and Fresh Water Shells and the Insects.

Mr. Christy's Bats have been also mounted on stands.

The collection of Essex Sea-weeds presented by Mr. Hope has been arranged in boxes, and most of the botanical specimens have been mounted on papers.

The arrangement of the specimens from the Deneholes, and the Redhill specimens, presented by Mr. W. Cole, has been almost completed.

All the Birds received from Colchester, and those in the Museum, have been thoroughly cleaned, kyanised, and mounted on beech-wood stands, and the labelling of these specimens is being rapidly proceeded with. This is also the case with the few specimens of Mammalia other than the Bats at present in our possession.

All the cased birds belonging to Mr. Smoothy have been thoroughly cleaned and kyanised, and are now in excellent order. The Council has agreed with Mr.

Smoothy's opinion that these should be removed as soon as possible, as they are not Essex specimens, and being only on loan, the large cases present almost unsurmountable difficulties in the proper arrangement of the Museum.[1]

Mr. Mothersole is now only employed one day per week, and consequently the work is greatly delayed, but I claim that our exertions are already bearing fruit, and that the collections are increasing, if but slowly. The task of cleaning the specimens, reconstructing the cases, etc., and repairing the neglect of many years has been exceedingly heavy, and I must confess that I get absolutely no help from those who at the commencement promised aid. Several collections, such as the type collections of plants, the educational series of animals, and the mollusca, are still not arranged, although at least eighteen months ago we prepared all the cases and procured the boxes, slabs, bottles, etc., required for the setting-up of such collections. I can only appeal to those gentlemen to bestir themselves. I work as much at the Museum as possible, but *more time* is necessary. It is most desirable that the Museum should be opened as soon as possible, but much remains to be done, and a very considerable capital expenditure is still imperative. Also if the Museum is to be opened, some arrangements as to caretaking, cleaning, lighting, warming, etc., would be absolutely essential, and some of the collections (particularly the geological series) would need skilful aid in determining the species and arranging the proposed educational and other series.

The Council now propose very carefully to consider the subject of the Museum, and nothing further can be usefully said until some decision is come to on the question of maintenance. I simply present this Interim Report that the members may see that although the work is necessarily slow, we are doing all we can with the means at present placed at our disposal.

WILLIAM COLE,
Hon. Curator.

March 28th, 1896.

REPORT ON THE PROGRESS OF THE EPPING FOREST MUSEUM.

[*Presented by the Hon. Curator at the Annual Meeting, March 28th, 1896.*

THE origin of the scheme for the establishment of a Local Museum to illustrate the Natural History, Geology, and Antiquities of the Old Waltham Forest District was briefly detailed in the report of the meeting held at Queen Elizabeth's Lodge on February 24th, 1894, and published in THE ESSEX NATURALIST (vol. viii., pp. 44-48).

At this meeting, which was attended by many gentlemen well qualified to speak on such a subject, the following resolutions were unanimously passed:

"This meeting is of opinion that it is desirable (with the consent of the Conservators) that a small, free Local Museum should be established in Queen Elizabeth's Lodge, and pledges itself to do all in its power to promote the same.

"That a subscription list for raising the necessary funds be at once commenced, so that the Local Committee may be enabled to approach the authorities with the definite scheme."

In accordance with these resolutions a local Committee was at once formed, the appointment of which was confirmed by the Council, and which now forms a Sub-Committee of the Club, and consists, at present, of the following members: Rev. A. F. Russell (*Chairman*), Mr. B. G. Cole, Mr. H. A. Cole, Rev. W. T. Dyne,

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[1] Mr. Smoothy has since removed all his specimens from the Museum.

Mr. R. J. Sheldon, Mr. G. E. Vaughan, Mr. T. H. Wilson, Rev. W. Linton Wilson, Mr. A. Lockyer (*Hon. Treasurer*), Mr. W. C. Waller (*Hon. Librarian*), Mr. W. Cole (*Hon. Curator*), and the President and Officers of the Club *ex officio*.

An illustrated pamphlet explaining the objects and plan of the proposed Museum was issued, and a subscription list started. My rough estimate, as Hon. Curator, of the necessary expenditure was £300, but the Committee and Council decided to commence with a less sum, leaving further appeals for funds to be made after the Museum should have been opened. A considerable number of subscriptions were promised, amounting to about £120, with a few annual subscriptions, a list of which is placed on the table to-night, and which includes a donation of £20 from the Drapers' Company.

A carefully considered scheme was drawn up and placed before the Epping Forest Committee of the Corporation of London for approval. The Committee met the wishes of the Club in a very kind way, and on the 31st of December, 1894, the Agreement for the use of the Banqueting Room and the grand staircase of the Lodge for the purposes of a public Museum was signed by the Town Clerk of the Corporation and by myself, as Secretary to the Club. Under the arrangement the Epping Forest Committee provide a caretaker and pay for the warming and cleaning of the Museum.

It would be tedious to recapitulate all the steps taken in fitting up the Museum—its present condition is still very far from the ideal set before us in the preliminary pamphlet published by the Committee—but I think that we are justified in saying that good work has been done, and that even in their present state the collections are of considerable interest to visitors to the Forest. Welcome aid has been afforded by members of the Local Committee and others; many have helped, but it is only just that the Club should be informed of the SPECIAL ASSISTANCE afforded by the following gentlemen:

Mr. Chalkley Gould. Fitting up and defraying much of the expense of arranging his loan collection of articles of Romano-British age from Chigwell, as well as writing a Guide, and paying part of the cost of printing the same.

Mr. Walter Crouch. Arranging his loan collection of Mollusca from the Becontree Hundred, and lending several interesting specimens of birds from the Forest districts.

Mr. J. A. Clark. Lending many rare birds from the Forest, and presenting a set of about 70 species of the larvæ of Lepidoptera from the Forest.

Mr. Ll. Hatton and *Mr. H. Day* also lending for exhibition many rare birds.

Mr. J. E. Greenhill's loan of a valuable collection of Stone Implements and Pleistocene Mollusca and Mammalia has already been reported, but Mr. Greenhill has since partly arranged his collections, and has lent a typewriter, which has been of great service.

Mr. T. V. Holmes has presented six sheets of the 6 in. Ordnance Map of the Forest District, as well as two sheets of the Geographical Map, sheet of Horizontal Sections and sheet of the No. 12 Index. This donation has enabled us to prepare and have mounted on a spring-roller a complete large-scale Map of our district.

Mr. T. Hay Wilson generously defrayed half the cost of this somewhat costly mounting.

Mr. T. Hay Wilson has been engaged also for some time in collecting and preparing a set of rock specimens illustrating the Glacial geology of the Forest.

Mr. G. E. Vaughan, as already reported last year, presented a large collection of birds' eggs to form a type collection.

Dr. M. C. Cooke. A series of about 450 coloured plates of Hymenomycetal Fungi of Epping Forest, extracted from his "Illustrations of British Fungi."

In addition to the above, other donations should be mentioned which have been extremely useful: *Messrs. Chapman and Hall*, a copy of Oliver's plates of the Natural Orders of Plants to "cut up." *Messrs. Cassell and Co.*, some plates of birds. *Mr. Edward Stanford.*, a mounted copy of the official Map of Epping Forest. *Mr. B. Winstone*, a framed set of the illustrations by Mr. H. A. Cole in his book on the Epping Highway Trust, as well as other pictures. *Mr. W. C. Waller*, an ancient Deed relating to the Forest (framed). *Sir John Evans*, one of two ancient ornaments found at High Beach. *The Epping Forest Committee*, a complete set of the Reports of the Committee and other documents. *Mr. Deputy Halse*, a copy of Fisher's "Forest of Essex." *Mr. H. Day*, some objects found in the bed of the Lea. *Mr. Coales*, some specimens of Forest Lepidoptera. *Mr. Gellatley*, some Glacial Fossils from High Beach. *Mr. Brown, C.C.*, framed copy of cards issued on the occasion of the first visit of the Corporation to the Forest, and of the Queen's visit. *Mr. F. Coles*, specimens of Forest Fungi and Galls; while my brother, *B. G. Cole*, and myself have placed, or are placing, a large number of specimens from our own collections in the Museum.

With the very moderate sum placed at the disposal of the Committee to begin with, it would have been quite impossible to complete the fitting up of the rooms without the valuable aid afforded by *Mr. H. A. Cole*, who has not only actually made many of the cases, but has also devoted a large amount of labour and much time to the varied details of "fitting up." *Mr. H. A. Cole* and myself also devoted a fortnight of our vacations to continued work day by day in the Museum to get it ready for the opening, and *Mr. Lockyer* gave us his valued services for two days in writing labels, etc.

Among our lady members, *Miss Wilson* has cleaned and mounted specimens of plants, and *Miss J. E. Cole*, *Miss Cole*, and *Miss Adeline Cole*, have devoted much time to mounting specimens and plates, writing labels, and other work.

The issue of the extended "Guide" to the Museum has been deferred pending the completion of some of the collections. For the opening meeting I drew up a "Short Account of the Museum," of which an edition of 1,500 copies has been printed, in order to enable it to be used in making known the aims and objects of the Museum.

Mr. I. Chalkley Gould has written an excellent descriptive pamphlet of his collection, and has had it printed on terms very favourable to the Club, he himself generously defraying part of the cost.[1]

As the members of the Club are aware, the Museum was publicly opened by the Chairman of the Epping Forest Committee, Mr. Deputy Halse, on Saturday, November 2nd, 1895. It is unnecessary to detail here the events of the meeting, which was attended by most of the members of the Epping Forest Committee, and by many scientific gentlemen, including Sir Wm. Flower, Director of the British Museum of Natural History. The meeting was well reported in several newspapers and journals, and I would particularly call attention to Sir Wm. Flower's remarks as printed and commented upon in "Nature" and in "Natural Science."

The Club may be congratulated on having made a good beginning with this little Museum. But we ask our friends to remember that it is but a first sketch, as it were, of what might easily be made a most interesting and instructive exhibition. The collections at present exhibited are intended more for the ordinary visitor to the Forest than for the student of Natural History. For the benefit of the latter we must have complete collections of the Forest Fauna and Flora, stored in proper cabinets, and so arranged as to be easily accessible. Materials towards such collections are already in existence, or could be obtained in a few years; what is needed is persistent curatorial work, space, and money. The Committee have prepared a Statement of the requirements as they present themselves after due consideration of the matter, and propose issuing an appeal for further funds in order that the Corporation of London may be approached with a *request to put the Museum into a good position as a permanent institution*.

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[1] "Notes upon the Romano-British Settlement at Chigwell, Essex, with a description of the articles exhibited in the Epping Forest Museum," 1895. Price 6d., post free.

The ideal placed before the public in our prospectus and later pamphlets is one well worthy of attainment, and the Committee is convinced that this ideal can be approached if encouragement to persevere is given by the frequenters and admirers of our noble Forest and those who desire to encourage the study of natural history as a rational amusement and means of education.

WM. COLE,

March 28th, 1896. *Hon. Curator.*

THE PRESIDENTIAL ADDRESS.

DELIVERED AT THE SIXTEENTH ANNUAL MEETING, ON MARCH 28TH, 1896.

By DAVID HOWARD, J.P., F.C.S., ETC.,

LADIES AND GENTLEMEN,—The work of the Essex Field Club during the past year presents features of considerable interest. The Club has again afforded, both to its members and to visitors, an opportunity of judging how far the outcry raised in some of the daily papers against the management of Epping Forest has any justification. The Club holds no brief for the Forest Committee, but I think it is the almost unanimous opinion of the members that the advisers of the Forest Committee have fully justified the action they have taken. The management of forests, and most of all of a forest so neglected in the past, is a difficult technical science, and singularly unfitted to be undertaken by the general public guided solely by the misrepresentations of writers in search of copy, and by photographers who have shown what can be done in the way of the *suppressio veri* and of the *suggestio falsi.*

Of far more permanent value has been the work of the Club in establishing the Epping Forest Museum; owing to the labours of love of the Committee appointed for the purpose, and above all to the untiring zeal of our Secretary, Mr. W. Cole, a beginning has been made of a museum worthy of the manifold interests of the Forest, and on the true lines that make a museum of real value. It is difficult for us to realise how great the need is for a real knowledge of even the elementary points of interest in the Forest among the immense majority of the visitors to it. Still we only regard the work so far as a beginning; there is a great need of work and money to carry out the scheme we have set before us, and of such arrangements as shall ensure the permanence of the Museum.

It is much to be desired that we could report a like measure of progress in the Central Museum at Chelmsford. Our Secretary has spared no pains to carry out the aim of the Club—that the Museum shall be arranged in a manner worthy of the County Town—and the delay in the completion has certainly been no fault of his. So important a scheme must call for considerable expenditure, and the very moderate finances of the Club do not allow of their providing sufficient funds without extra assistance. Our appeals have certainly so far not met with the response in the county that we had anticipated, and we now seem to have got into the vicious circle, that till the Museum is completed we cannot get local interest and support, while without local interest and support we cannot complete the Museum. The position is a somewhat anxious one for those who have the interests of the Club at heart, and merits their most careful consideration.

I must not forget to refer to the great loss which the Club has sustained in the death of our Hon. Counsel, Mr. Charles Browne, who so often generously gave us the benefit of his skilful assistance.

We also lose the valuable assistance of our Treasurer, Mr. Lockyer, who has so long devoted his time and skill to our service, and while recording our hearty thanks we rejoice that he is not going so far from his old home that we may not hope to see him often with us. It is with great satisfaction that we entrust our finances, at any rate for a time, to Mr. Waller, our valued Librarian, who has so kindly taken upon himself a double office.

THE WATER SUPPLY OF THE LEA VALLEY VIEWED IN THE LIGHT OF RECENT RESEARCHES.

And now I will turn to a subject less immediately connected with the work of the Club, but one of great importance, and which it is most essential should receive an impartial and scientific consideration, viz., the Water Supply of the Lea Valley. Half a century ago the question would have seemed below the notice of a society like ours. Any fairly palatable water from a stream, whatever happened to it above the intake of the water, or from a well, about which no questions were asked as to the neighbourhood of cesspools and drains, was considered fit for domestic use. Some of the pumps, the water of which was specially sought after, owed their pleasant flavour to an abnormal amount of carbonic acid and nitrates, which were easily accounted for by the close proximity of churchyards.

Twenty-five years ago the subject would have been considered unfit for us, as being merely chemical, and only suited for Burlington House. We now find that the question of water supply involves the study of biology and physiology not less than that of geology and chemistry.

It is an interesting lesson on the interdependence of different sciences when they are to be brought into practical use.

The first advance towards purity in water supply was made by the help of chemistry. Even the very crude methods of analysis of my student days (taking the dry residue of the evaporation of the water and reckoning as organic matter the loss sustained on heating to redness, and treating with solution of carbonate of ammonia and again drying) was sufficient to condemn a large proportion of the water supply. Residues of over 100 grains to the gallon, which when heated lost 20 to 30 grains, giving off a strong smell of burnt horn, were not uncommon. It is not to be wondered at that outbreaks of cholera and fever were plainly traceable to the accidental supply of such organic matter a little fresher than usual.

When more reliable methods of analysis were brought to bear, and methods were introduced for the estimation of the oxygen consumed in oxidizing organic matter by permanganate solution; of ammonia and albuminoid nitrogen by the various applications of the Nessler test; and for the accurate determination of carbon and nitrogen in the dry residue by combustion with copper oxide; the difficulty arose how to interpret the results.

Albuminoid ammonia certainly seemed a danger signal, but how could we condemn a water supply on evidence of its presence, when Loch Katrine, and most other peat waters, gave higher results than some wells and streams undoubtedly polluted by sewage. It was easy also to regard any nitrogen as the result of previous sewage contamination, but it would seem in view of the presence of soluble nitrates in pure chalk rock that the supposed sewage contamination might have been derived from antediluvian animals. Experience showed only too clearly, as, for instance, at Caterham, that water might receive the most deadly pollution without appreciably affecting the chemical constitution.

Chemistry also failed to explain the purification of rivers after some measure of pollution; in fact, some chemists denied that purification could take place at all, because water shaken in bottles or running along glass troughs was not purified.

A real grasp of the whole problem only became possible when the study of micro-organisms had thrown a light both on the real mode of communication of water-borne disease, and of the changes that go on in water itself.

The first attempt in the direction of Bacteriological study applied to water seems to have been made by the late Dr. Angus Smith, who called attention to the great differences shown by samples of water when mixed at a moderate temperature with a sufficient quantity of gelatine to set into a jelly on cooling. Some samples remain for a considerable time without change; others in a very short time begin to liquefy in more or less numerous points, and very soon show signs of decomposition. Dr. Smith left it, however, to other workers to carry out these investigations with more accurate methods; and in this country we owe to Dr. Percy Frankland's well-known investigations a clear recognition of the importance of this method of the biological study of water. Fuller investigations have developed methods of cultivating the micro-organisms present in water in such a way as to select particular ones from a number of others, and so develop their colonies as to enable the expert to identify them with certainty. Unless this is done we only get the information that there are an alarming number of organisms in the water we drink, which may be very deadly to the human frame, or which may be as harmless as mites in cheese, or, possibly, even beneficial.

A very practical result of these researches has been to show the enormous value of the system of filtration through sand which has been adopted by the Water Companies as the result of engineering experience and skill, and which now proves to have excellences the very need for which was not known when the process was worked out. The entire separation of all organisms and germs from water is a most difficult result to obtain by mere filtration; even with unglazed porcelain, though for a time the liquid passes through sterilized, sooner or later it allows germs to pass, and may even give a filtrate which has picked up more organisms in its passage through the filter than were originally present in the liquid; and thus these filters require frequent sterilization to make them safe, and less perfect filters of the familiar household type may easily become *foci* for the propagation of bacteria, doing a great deal more harm than good.

It is therefore evidently hopeless to expect that mere mechanical filtration on the enormous scale required for the water supply of a great population can be efficient; and yet chemical, and still more biological, analysis shows that the sand-filter beds of the Water Companies work an improvement in the quality of the water that is simply marvellous, reducing, according to the last published report, the "colonies" of bacteria from 1,100 to 29.

The interstices of the filter are clearly too large to produce this result by mere filtration, and if it were owing to mechanical deposit on the surface of the grains of sand any slight increase in the speed of the percolation would carry through the filter the accumulated impurity. I think it is clearly proved that the purification effected is the work of organisms which attach themselves to the sand and entangle and actually feed on the bacteria contained in the water passing through the filter.

A similar process is evidently going on along the whole course of streams which are not so hopelessly polluted as to destroy the beneficial organisms which can feed on hurtful ones, and continue in the water the process of assimilation of matter in a state of noxious decomposition that is so familiar in every cultivated field.

In applying these results to the question of water supply, we see that we may adopt various means to obtain that measure of purity that we need. We may take a water supply from valleys in hard, primary rocks, so far from centres of population that sewage pollution cannot exist, and thus obtain a water of great purity and softness, but generally discoloured by peat, and often showing a dangerous tendency to corrode lead. In the case of London, this means bringing a water supply from the higher valleys in Wales. Again we may trust for freedom from contamination to natural filtration through deep beds of rock; in this case the amount of filtration of the water depends on the freedom of the rock from flaws and faults; nothing short of solid rock appears to be at all effectual. Experience in Switzerland shows that a stream infected by typhoid germs will pass unpurified through a very great distance in the coarse gravel of an old moraine, and as the purifying organisms, whose work in shallow sand-filters I have mentioned, require air, little or no purification appears to take place in water streams below the surface.

The most perfect natural filter is *chalk*. The water from deep chalk-wells is far freer from organic impurity and organisms than any other natural water. In common with all other water from deep sources it contains as much of the constituents of the rock filter as the water can dissolve, but water containing dissolved carbonate of lime, though inconveniently hard, is not unwholesome, and can be easily purified either by boiling or by chemical means.

The remaining supply of pure water is afforded by the self-purification of streams of which I have spoken. It is evident that too much care cannot be taken to avoid initial contamination, and zealously to guard against any interference with the stream for a long distance above the intake. If the water from a river thus guarded be efficiently filtered, it gives a water supply which experience shows to be quite as wholesome as any other.

The supply obtainable from the Lea Valley naturally falls under the two last classes, and in many ways presents exceptional advantages.

The great Chalk basin overlaid in the lower portion by the London Clay gives the double supply that forms the springs in the upper valley of the Lea (which yield water of infinitely greater purity than that of the springs and drainage that fill most rivers), or water from artesian wells, affording an inexhaustible supply near or at the surface.

It is hardly too much to say that the visible stream is but a portion of the great river that flows in more or less defined channels in the solid Chalk. In the upper valley, the water level is almost exactly that of the stream in the valley, through however great a mass of chalk the well may be sunk; while in boring artesian wells in the lower valley the depth at which water is reached, and the supply obtained, entirely depends on the magnitude of the stream which is struck in the chalk. The Woolwich Beds above the Chalk often yield a considerable supply, but one not to be compared in quantity or purity to that from the solid Chalk below, if the boring is carried down till a good stream is struck. The level to which the water rises in the well does not differ greatly in different bores, thus showing that the original level of the subterranean streams is not widely different; but the character of the water varies much within comparatively small distances, thus showing that the channels run a long way without mixing.

In wells near the Thames it is sometimes found that if pumped too fast they give brackish water, thus showing that they are near the outlet of the channel.

Without entering into so burning a question as that of the water supply of London, I may venture to express a doubt whether Wales, or even Westmoreland or Cumberland, affords a safer gathering ground for water than the Lea Valley. For full utilisation of the supply there are various problems to be considered, and not the least of them is how much water can be drawn from the Chalk itself and how far the level of wells and streams in the Upper Chalk is affected by pumping from artesian wells in the Lower Chalk. On these points there is great difference of opinion, and the question can only be answered by careful observations of what is happening during a particular period, and by comparison of all the records obtainable of the effect of drought and flood upon wells in various situations. We need all the information obtainable to trace the course of subterranean streams and to form a complete idea of the relation of the volume of the streams above and below ground.

So far as I know, the evidence is that a period of about six months elapses between the occurrence of a wet season and any perceptible rise in the level of water in an artesian boring, when the water is allowed to rest till the level is constant.

One side of this question is how far a drainage of the Upper Chalk, brought about by pumping from artesian wells, is followed by a diminution of the liability to flood, and how far the Chalk can be utilised as a reservoir against dry seasons. If the surplus water could be stored in the Chalk itself, instead of exercising the ingenuity of engineers to get rid of it as an evil, it might be possible to find a reservoir vast enough to foil even the machinations of the London County Council.

It is interesting to look back to the first recognition of the value of the water supply of the Lea Valley, in the great work of Sir Hugh Myddelton. As not unfrequently happens, the insight and foresight of a great genius not only provided a source of supply fulfilling all the requirements of the severest judges of his own day, but one also which the most enlightened critic of the present times cannot condemn.

To choose the springs of wells capable of supplying distant London, and then to bring the stream uncontaminated to the town, was even a greater triumph of sanitation than of engineering.

To carry the water all the way in culverts or pipes would probably now be considered a preferable arrangement; but it is by no means certain that such a method of conveyance gives a water really purer and softer than that conveyed by an open stream, especially when the air is free from smoke, as it was in Hugh Myddelton's time. The pity is that so perfect a supply as that of the river in his days is so insufficient for the needs of the vast population that has grown up since—a need the vaster inasmuch as we now consider no water fit to flush a drain that is not fit to go down our own throats. Are we quite sure that this fastidiousness is progress in the right direction in a matter of such vast importance to the future of London?

The water supply drawn by the East London Water Company from the Lea Valley commenced under very different conditions from those dealt with by Sir Hugh Myddelton. The introduction of steam pumping machinery enabled the engineers when the Company was founded to raise the water to the required level of the reservoir on the top of the mound that used to be so familiar an object at Old Ford from the river below. I have a letter from my great-grandfather to my grandfather describing the pumps then being erected as a triumph of engineering. It is difficult to realise that the Lea then, even so far down as Old Ford, was a beautifully pure stream, far purer than the water supply of most towns at that time. The inhabitants were few and the drainage *nil* for a very long period; now, however, the increasing pollution of the stream and increasing demands for purity in water supply have necessitated separate channels for the Company's water far above the pumping station at Lea Bridge. Those members of the Club who joined in our Lea excursion in June last had an opportunity of inspecting not only the comprehensive arrangements for sand filtration of the river water, the results of which are to be seen in the reports of the water examiners, but also some of the great chalk-wells which increase to no small extent the resources of the Company. No one who was present on that excursion will forget the greatly-added interest derived from the explanations of

Major Lamorock Flower of the work of the Lee Conservancy, or those of the able Engineer of the East London Water Company of the arrangements at Lea Bridge. It were well if some of those who undertake to enlighten the public on the subject of water supply would learn for themselves how much skill and thought has been given to the subject.

And now I must make an end to this very brief and imperfect sketch of a very wide and important subject, one upon which I have no right and no wish to dogmatise. I would, however, venture to express a very strong opinion that in the water supply of the Lea Valley we have a natural provision of the greatest value which ought never to be overlooked when ambitious and costly schemes for providing for the needs of the metropolis and its surroundings are discussed.

THE BARCLAY-JOHNSTON MSS. AND PAPERS RELATING TO EPPING FOREST.

Now in the Library of the Essex Field Club.

By W. C. WALLER, M.A., F.S.A. (*Hon. Treasurer*).

[*Read June 27th, 1896.*]

IN the late spring of 1895 I, as one of the two Hon. Librarians, received from the Hon. Secretary of the Club a box containing an undigested mass of pamphlets, papers, and books, in manuscript and in print, relating in the main to Epping Forest, which had been sent to him by Mr. Andrew Johnston and the executors of the late Mr. Henry Ford Barclay, of Monkhams. Mr. Barclay, it will be remembered, was a member—and for a time, I think, Chairman—of the Commissioners appointed by the Epping Forest Act, 1871, which sat from 1872 to 1877, and received the evidence subsequently printed in four great volumes of a thousand pages each—volumes which, though unfortunately not included in the present collection, are, it may be said in passing, always accessible in the Guildhall Library of the Corporation of London. Mr. Johnston, whose interest in forestal matters was great, became a Verderer under the Epping Forest Act of 1878; and it is to his antiquarian instinct that we owe the preservation of many papers, the value and interest of which will increase with each passing decade.

My first care was to roughly classify the documents according to their subjects. This done, they were listed on slips, and, where binding seemed possible, those that lent themselves to that treatment were arranged in groups to form handy folio volumes. The result has been that the whole collection (exclusive of the *Rolls of the Court of Attachments* already bound up in four volumes) is now contained in nine boxes and six volumes, lettered consecutively *A* to *O*. The separate documents contained in the volumes and boxes are also numbered consecutively, and attain to a total of 257. A slip-calendar (bound) affords ready means of reference to these; and the brief account I now propose to give of them will enable our members to see at a glance under which group, or groups, the matter falls in which they happen to be more particularly interested. The boxes and volumes are included in that part of the Club Library which is domiciled in the Epping Forest Museum at Queen Elizabeth's Lodge, and anyone desiring to examine their contents should communicate with the Hon. Librarian.

Box A (1-10).—This contains manuscript copies of some reports made for the Epping Forest Commission, and of claims sent in to them, together with the Memorandum as to the City's right to hunt in Epping Forest, a full account of which appeared in vol. viii. of THE ESSEX NATURALIST; and a copy of the speech made by the City Solicitor in 1876.

Box B (11-23).—Schemes for the future management of the Forest, ranging from 1874 to 1877, and including that of the Commissioners themselves, form the staple of the contents of this box.

Box C (24-34).—Two schemes for the management of the Forest, and several official reports (ranging from Mr. Arthur Butler's, which is dated December 24th, 1874, down to one on Way-leaves in Chingford, in July, 1885), will be found in this box.

Box D (35-47).—Notices relating to the acquisition of Wanstead Park, Fairmead Lodge, and The Sale, form a part of this group, together with a large bundle of official summonses to attend meetings of the Epping Forest Committee of the Corporation, ranging between the years 1878 and 1887, and copiously annotated. These are remarkably interesting, as furnishing many details of Forest management over the period during which the foundations of a policy were being laid.

Box E (48-73).—This may be styled the Verderers' box, containing as it does notices, letters, analyses, addresses, and accounts, all relating to the elections in 1880, 1882, and 1887.

Box F (74-105).—The contents of this box are so miscellaneous that it is not easy to characterise them briefly. Communications respecting enclosed lands, newspaper-cuttings, pamphlets on management and rejoinders to them, Commoners' grievances, and other such matters, are there represented.

Box G (106-136).—This box comprises documents referring to the Commoners and the Reeves, with Statements, ranging from 1878 to 1885, of the Epping Forest Fund of the Corporation of London.

Box H (137-157).—The Epping Forest Fund of 1874 and succeeding years is here represented by various Reports and Statements of Account; and one or two miscellaneous items lie with them.

Box I (158-162).—Two fine plans of the Forest District, north and south, mounted on linen, together with books of reference to them, prepared by Mr. R. C. Driver for the Epping Forest Commission, with his affidavit, form the very valuable contents of this, the last box on the list.

Vol. J (163-178).—The title of this volume, which is lettered "*Acts and Bills*, 1849-1884," sufficiently indicates its contents.

Vol. K (179-185).—A long Chancery suit—The Commissioners of Sewers *v.* Glasse and others—finds its record in this volume, which ends with the famous judgment of the Master of the Rolls, dated Nov. 10th, 1874. It also includes a report of the researches made by Mr. H. G. Hewlett, and a copy of the *Perambulation of the Forest* made in the time of Charles I.

Vol. L (186-205).—Documents relating to Hainhault Forest and others, with the interesting extracts from the Forest and Court Rolls which were printed for the Epping Forest Commission, and a summary (dated 1874) of the legal and other proceedings taken respecting Epping Forest since 1871, form the staple of this volume, lettered "*Forests.*"

Vol. M (i. 206-212).—This volume, lettered "*Epping Forest Commission, 1871-1875,*" contains yet more of the matter printed for the use of the Commissioners, together with their preliminary Report, dated Dec. 27th, 1875.[1]

Vol. N (ii. 213-227).—Comprised in this volume, which is lettered "*Epping Forest Commission, 1875-1878,*" are the schemes for the management of the Forest which were received in response to a notice issued by the Commissioners in 1875, and printed with their own Scheme and Final Report soon after May 3rd, 1877.

Vol. O (228-257).—This last volume contains the official Reports of the Coal, Corn, and Finance Committee of the Corporation of London for 1875 and 1878; and the Reports of the Epping Forest Committee of the same Corporation from 1882 to June 1895, of which some are rightly included in the Barclay-Johnston Collection, having been contributed by Mr. Johnston; but the larger number was recently presented to the Museum Library by the Epping Forest

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[1] It should be noted that M 208 and M 209 are indices to certain volumes transferred from the Office of Works to the Public Record Office in 1893, for safe custody. These are not, however, "Public Records," and a special permit is required in order to inspect them. They contain a great number of certified translations of office copies of records.

Committee, through whose courtesy succeeding issues will also, I understand, be forwarded as they appear.

By way of pendant to this meagre outline I must express the gratification I have had in arranging and cataloguing these papers, which, had it not been for the enlightened foresight of Mr. Johnston and of Mr. Barclay's executors, might easily have followed so many other valuable records to the funeral pyre. It is to be hoped that other residents in the neighbourhood of the Forest, stimulated by their example, may send documents of a like nature to the Library, there to be preserved for the use and instruction of those who, in the long years to come, may wander in an even nobler forest than that which we ourselves are privileged to behold.

[We may add that the Librarian and Curator will be very glad to receive copies of any books, pamphlets, reports, maps, etc., relating to, or containing matter relating to, the old Waltham Forest, its Topography, Antiquities, History, and Natural History, and of the various "fights for the free forest" from the earliest periods until now. It is particularly desired to obtain copies of the Minutes of Evidence of the Epping Forest Commission; the Minutes of Evidence at the trial of the action before the Master of the Rolls in 1874; and of early maps of the Forest district, particularly Chapman and André's fine map of Essex, etc. Any contributions, addressed as above, will be gratefully received at the Museum at Queen Elizabeth's Lodge, and donors will have the gratification of aiding in the gathering together of a perfect set of Forest literature, which at present nowhere exists, although the Field Club's Library is the most complete, probably, of any collection of such material.—ED.]

A SKETCH OF THE GEOLOGY OF EPPING FOREST.

By T. V. HOLMES, F.G.S. (*Permanent Vice-President*).

[At our request, Mr. Holmes has kindly written this short account of the Geology of the Forest District for the information of visitors, and to aid the Curators in arranging a series illustrative of the subject in the Epping Forest Museum.[1]—ED.]

FOR my present purpose it will be best to consider Epping Forest as the compact district included in the Perambulation of 1641. In other words, we may look on it as having the following boundaries: On the south, the high road between Stratford and Great Ilford. On the east, the alluvial flat of the Roding as far north as Chigwell Lane Railway Station, and thence (northward) the Epping and Ongar Railway as far as Coopersale Common. A line drawn from Coopersale Common in a north-westerly direction to Roydon on the Stort may be considered the northern limit, while the western is formed by the alluvial flats of the Stort and Lea from Roydon to Stratford.

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[1] The reader may be referred to the under mentioned papers, in addition to those mentioned, on the geology of certain parts of the district, recently printed in THE ESSEX NATURALIST: "Geology of the Lea Valley," by T. V. Holmes, vol. viii., p. 198; "The Gravels near Barking Side, Wanstead, and Walthamstow," by H. W. Monckton, vol. vii., p. 115; "Notes on the Gravels in Epping Forest," by T. Hay-Wilson, vol. vii., p. 74; "Geological Notes in the Neighbourhood of Ongar, by H. W. Monckton, vol. vii., p. 87; "On the Boulder Clay in Essex," by H. W. Monckton, vol. iv., p. 199.—ED.

Within the above boundaries the oldest formation occupying the surface is the London Clay, though the Woolwich and Reading Beds, which underlie it, have been met with here and there beneath the old river gravel which covers so much ground towards the southern margin of the Forest. At Dagnams, about three miles N.E. of Romford, the London Clay was found to be 400 ft. thick, and it probably reaches an equal thickness in Epping Forest. A well-section at Loughton, the details of which are given in Mr. Whitaker's Memoir on "The Geology of London and of Part of the Thames Valley," vol. ii., p. 25, shows that the London Clay was there 250 feet thick, though its full thickness could not have been ascertained. A boring through the little outlying patch of Bagshot Sands at High Beach would be the only one within our boundaries giving the full thickness of the London Clay. For the Lower Bagshot Beds, which overlie the London Clay at that spot, belong to the same Eocene series, and rest conformably on the last-named formation, while the various patches of Gravel and Boulder Clay which are found elsewhere on the surface, resting upon the London Clay, are of post-Pliocene age, and consequently highly unconformable. In other words, the London Clay and the overlying Bagshot Beds were deposited continuously, there having been no waste of the upper strata of London Clay previous to the deposition of the Bagshot Sands. On the other hand, the various post-Pliocene Beds were laid down only after the London Clay had been subjected to much erosion during the long interval between the Eocene and post-Pliocene eras. Consequently only when we bore through Bagshot Beds, and then through the London Clay beneath, do we ascertain the full thickness of the latter. (See Fig. 1 Section through High Beach.) Of course, in sinking wells, people naturally go through as little London Clay as practicable, and the perusal of well-sections tends to erroneous notions as to its full thickness unless the foregoing considerations are remembered.

From another well-section at Loughton we learn not only something about the London Clay but about the thickness of the beds beneath, which do not appear at the surface in our district, though they may be seen in North Kent, and also in South Essex between Purfleet and Grays Thurrock. It is given in Mr. Whitaker's Memoir, already mentioned, and is at the G.E.R. Station.

	London Clay ...	167 ft. ...	167 ft. depth.
Reading Beds.	Sand	26 „ ...	193 „
	Clay and Stones ...	10 „ ...	203 „
	Thanet Sand ...	40 „ ...	243 „
	Chalk	648½ „ ...	891½ „

The London Clay forms, perhaps, four-fifths of the surface of Epping Forest. It is of a slaty-blue colour when fresh, but soon becomes brown on exposure to the air. The most prominent objects in a London Clay section are usually the masses of concretionary clayey limestone, with septa of crystalline carbonate of lime, known as *Septaria*. Fossils are not easy of detection, though abundant in many places, and conspicuous on the Foreshore below the London Clay cliffs at Sheppey and Herne Bay. Lowry's Chart of Tertiary Fossils is indispensable to those collecting shells or other fossils from the London Clay. It may be purchased from Stanford, Charing Cross.

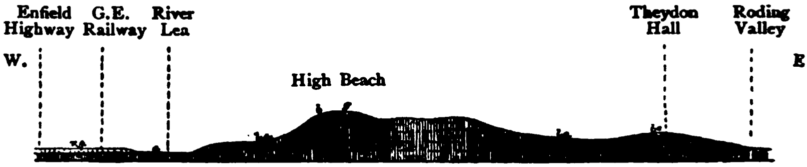

FIG. 1. DIAGRAM SECTION FROM ENFIELD HIGHWAY (W.) ACROSS HIGH BEACH TO THE VALLEY OF THE RODING EAST OF THEYDON HALL (E.). LENGTH of SECTION, 8 MILES.
l.c., London Clay. *b.*, Bagshot Beds. *g.*, the "Pebble Gravel" of Geol. Survey Map.
b.c. Boulder Clay. *r.g.*, River Gravel. *a.*, Alluvium.

The uppermost beds of the London Clay tend to become sandy like the Bagshot Beds, and thus form "passage beds" between the two formations. They may be seen in the higher parts of the Forest, as in Oakhill Pit, about a mile west of Theydon Bois Station.[2] It is often difficult to distinguish between the highest beds of the London Clay and the lowest of the overlying Bagshot Series.

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[2] See description by Mr. N. F. Robarts, "Trans. Essex F. Club," vol. iii., p. 234.

The Lower Bagshot Beds are mainly composed of sand, with partings of clay and loam. They cap many of the higher hills in the Brentwood district, and may be seen at Havering-atte-Bower. But in the Forest they are very scantily represented by the small patch at High Beach—already mentioned—and possibly by some sand at Coopersale Common.

There is a very considerable gap between the Eocene London Clay and Bagshot Beds and the strata next in age—as I have already stated when treating of the London Clay and its full thickness. The series of outlying patches of gravel, which are next to the Bagshot Beds in age, are found resting, sometimes on strata of the Bagshot series, sometimes on London Clay. On the other hand, they are evidently older than the Boulder Clay. On the map of the Geological Survey they are coloured red, and called "Pebble Gravel," and may be seen to occupy high ground at High Beach, Jack's Hill, Gayne's Park, and Coopersale Common, all places within or close to the Forest boundary. They are classed by Professor Prestwich as "Westleton Shingle." Those who wish to know what is implied by that name must be referred to Professor Prestwich's important paper on the "Westleton Beds" in the "Quart. Journ. Geol. Soc." for 1890, pp. 84-181.[3] He gives the approximate composition of the gravel at Jack's Hill, near the "Wake Arms," as follows:

1. Flint pebbles	50	per cent.
2. White quartz pebbles	15	,, ,,
3. Subangular fragments of flint	20	,, ,,
4. Subangular fragments of chert and ragstone	10	,, ,,
5. Pebbles of Lydian stone, etc.	5	,, ,,
	100	

At Coopersale Common (or Gayne's Park) as:

1. Flint pebbles	56	per cent.
2. White quartz pebbles	20	,, ,,
3. Subangular fragments of flint	9	,, ,,
4. Subangular fragments of chert and ragstone	12	,, ,,
5. Pebbles of Lydian stone, etc.	3	,, ,,
	100	

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[3] See brief review of this paper in Essex Nat., vol. iv., p. 100

We now come to deposits of Glacial Age. These consist of the Chalky Boulder Clay, which covers so large a proportion of the surface of the eastern counties from mid-Essex northward, and the sand and gravel associated with and underlying it. But though this Boulder Clay covers a considerable area east of the Forest, as far south as Chigwell and Havering-atte-Bower, and westward, in Middlesex, as far south as Finchley, it is confined to the north-eastern border of the Forest district. Scarcely any has been detected south-west of a straight line drawn from Abridge on the Roding through Nasing to the Stort. But the geological surveyors are inclined to identify some gravel patches of considerable size at Loughton, Buckhurst Hill, and Woodford with the Glacial Gravel usually found beneath the Boulder Clay. Small deposits of Boulder Clay have been elsewhere occasionally found in this gravel. Possibly some day some may be detected in or on this supposed Glacial Gravel of the Forest district.

As regards composition, the Glacial Gravel consists chiefly of flint, sub-angular or rounded, quartz and quartzite, flint predominating. Sometimes rolled fossils from the Lias and Oolite have been found in it. It varies very much in appearance, being at one spot well stratified, at another showing few, if any, signs of stratification. And at one section it may be mainly coarse gravel, at another chiefly sand.

The Boulder Clay is often called the Chalky Boulder Clay from the great number of Chalk pebbles it contains, most of which show glacial scratches. In a deep section this formation can hardly be mistaken for any other, though within two or three feet of the surface the Chalk and other limestone rocks have usually been dissolved away by the action of rain and its most marked characteristic thus removed. Where well shown it is seen to be a confused mass of rocks of various ages in a matrix of bluish-grey or buff-coloured clay. Chalk and flint predominate, then come fragments of rock and fossils belonging to the Lias and Oolite formations. *Belemnites* and *Gryphæas* are very common. It is evident that the rocks found in the Boulder Clay have been derived from the north, not from the south. But it is impossible to discuss here the various theories held by geologists as to the exact kind of ice action that has produced the Chalky Boulder Clay of the Eastern Counties. Some consider the chief agent to have been an ice-sheet, others incline to believe in icebergs or coast-ice.

From Walthamstow, southward, the surface consists chiefly of gravel of much later date and lower level than the Westleton Beds or Glacial Gravel. It belongs to the present Valley Systems of the Thames and Lea. It was deposited, however, by those streams when they flowed at a higher level than they now do, and having more fall brought down coarser material. It forms most of the surface of the Forest district about Forest Gate, Wanstead, Leyton, Leytonstone, and Walthamstow.

Then, lastly, we come to the lowest in level, and latest in date of all the geological formations in, or bordering on, the Forest district, the Alluvium of the Thames, Lea, and Roding; the most recent of the deposits formed by those streams. In the "Trans. Essex Field Club," vol. iii., pp. 1 to 29, will be found a valuable paper by Dr. Henry Woodward on "The Ancient Fauna of Essex," giving a most interesting account of the excavations made in the marshes of the Lea in 1868-69 by the East London Waterworks Company when constructing additional reservoirs, and of the fossil remains found therein. At the present time additional reservoirs are being made in the same neighbourhood, and the sections exposed may be compared with those given by Dr. Woodward. In both cases we find much variation in detail, but an excavation 6 to 8 feet in depth, in 1895 as in 1868, usually discloses clayey loam at the surface and gravel at the bottom, with variable thicknesses of peat or shell-marl, or both, between the loam and the gravel. Among the mammalian remains found in 1868-69, Dr. Woodward mentions those of the wolf, fox, beaver, horse, wild boar, reindeer, gigantic ox (*Bos primigenius*), and elk. But those wishing for a complete list must refer to Dr. Woodward's paper.

References.—In addition to Mr. Whitaker's Memoir already mentioned, Sheet 120 of the Horizontal Sections of the Geological Survey from the Chalk of Farningham, in Kent, to the outcrop of the Chalk in the valley of the Ash, at Widford, will be found extremely useful to the student of the geology of Western Essex.[4]

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[4] "120. From S.E. of Farningham, Kent, across the Valley of the Thames below Greenhithe; through Essex, to the Valley of the Ash at Widford. (1871). [Maps 1, N.W., S.W., 6, 47]." 5.

QUEEN ELIZABETH'S LODGE, CHINGFORD.

By JAMES CUBITT, F.R.I.B.A.

[When it was decided, by permission of the Corporation, to form a Museum in the Lodge, Mr. Cubitt very kindly made a careful examination of the building and wrote the following Report, which will be interesting to all visitors to the Museum and may be taken as supplementary to Mr. W. C. Waller's paper, "Two Forest Lodges," printed in THE ESSEX NATURALIST, vol. vii., p 82.—ED.]

THE whole of this building is remarkable for the size of its timbers and the solidity of its construction. It differs, too, from most wooden houses of the same period by the absence of overhanging storeys and similar projections on the outside. Before restoration, the main timbers seem to have been concealed, at least externally, and old prints show but few windows, and those square-headed casements.

In its present state the Lodge contains no visible trace of distinctively Elizabethan detail. To all appearance it dates from about the end of the fifteenth century. It is oblong on plan, measuring 30 feet by 20 internally, with a separate staircase 15 feet square. The stairs are wide and easy of ascent; they are in short flights with frequent landings. What in ordinary cases would be the central well-hole is enclosed, not by a handrail, but by a partition, which forms a vertical flue or shaft, reaching from the lowest storey nearly to the roof. This enclosure may have been only a special arrangement for safety, though uses to which it could be put will readily suggest themselves. In some old Scottish buildings, such as Glamis Castle, a shaft or well in a similar position was provided to hold the lines and weights of a clock.

The Lodge contains three storeys. The lowest is occupied by living rooms and store places; the next, there is every reason to believe, consisted originally of one large apartment, though it has long been divided into three rooms and a passage. But the partitions which separate these are of the roughest kind, quite unlike the architecturally-designed timber work of the original building. They have no structural connection with it, and the handsomely-moulded beams which originally carried the ceiling were evidently meant to cover an undivided room. On the staircase landing at this level, there is a late Gothic door-frame with a low "four-centred" head. Its triangular spandrils are filled, not with carving, but with a mere outline, incised so as to suggest a carved leaf, of that three-lobed type which was commonly used in such places during the Perpendicular and Tudor periods.

The second floor still remains as one room. Its roof is the most interesting part of it, and indeed of the building generally. It is divided into three bays by very substantial roof-trusses. Although the span is scarcely 20 feet, the principal rafters are 13 inches in thickness. They are connected by wide collar beams, below which there are well-proportioned "four-centred" arches of oak, moulded on both faces. The purlins, too, are large, and are secured diagonally to the trusses by windbraces of similar arched form. As it usually happens in old work, the timbers are all laid with the broader side downwards; not set on edge according to the modern custom. The carpentry altogether is good in design; though, considering how near it is to the eye, its mouldings might have been the better for a little more delicacy and refinement. But the craftsman who made it had learned his art, probably, in roofing church naves and lofty halls, and hardly made allowance enough for the lowness of the room he was here dealing with. The boldness of his details would be admirable if they were only fixed a few feet higher; and even as it is, their excess of strength and spirit is a failing which leans to virtue's side.

SOME ESSEX WELL-SECTIONS.

(PART IV.)

WITH SOME WATER-ANALYSES.

By W. WHITAKER, B.A., F.R.S., F.G.S., Assoc. Inst. C.E.

[*Read June 27th, 1896.*]

TO the accounts of 277 Essex Wells already published,[1] I am now able to add 49 of others that have not been printed, making 326 in all. Some day, perhaps, when County Councils are led to help in such work, the whole of these may be collected together into a volume on the Wells and Well-waters of Essex.

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[1] Mr. Whitaker's previous papers on Essex Well-Sections will be found in our publications as follows: Part I., "Trans. E.F.C.," vol. iv., pp. 149-170; Part II., ESSEX NATURALIST, vol. iii., pp. 44-54; Part III., E. N., vol. vi., pp. 48-60. In the first of these papers Mr. Whitaker catalogues the 130 Essex Well-Sections published previously in the Geological Survey Memoirs, and gives some general details relating to the subject.—ED.

To that end I shall be glad for any further information that can be given, and also for copies of unpublished analyses of waters from wells or springs.

Having already twenty such analyses, which I believe to be unpublished, I append these in this paper.

The numbers (in brackets) at the head of each section, or analysis, are those of the sheet of the Geological Survey Map in which the site is represented.

Unless otherwise stated, the figures, for thickness and depth, are in feet.

[Words in square brackets have been added by the writer.]

(1, S.W.) **Barking.**—*East London Waterworks (half-a-mile from the western side of the town, just east of the Roding, and close to the main road.)* 1896.

Communicated by Mr. W. B. Bryan, Engineer to the Company. About 12 feet above Ordnance Datum. Shaft throughout.

		Thickness.	Depth.
Soil		2	2
[River Drift, 17½ feet.]	Loamy clay	5	7
	Hard gravel	5	12
	Cleaner gravel over	7½	19½
[London] Clay		21	40½
[? Basement-bed of London Clay, or partly Woolwich Beds ?]	Shells (? about 4 inches) over		40½
	Very dark soft sand nearly	1½	42
	Sandstone rock „	1½	43½
	Very dark soft sand	1¼	44¾
	Two-inch layers of sand, clay, pebbles, and shells	2¾	47½
	Soft clay and shells	1½	49
	Hard shell-rock	¾	49¾
[Woolwich Beds, 34¼ feet.]	Shelly dark green sand	8¼	58
	Very hard dark clay, with shells	6	64
	Loamy sand over	3	67
	Light-grey sand nearly	5½	72½
	Dark sand	5½	78
	Clay and sand	3½	81½
	Loamy sand and black pebbles	2½	84
[? Woolwich Beds or Thanet Sand.]	Dark grey sand nearly	19	103
	Dark sand and pebbles	5	108
[Thanet Sand, 33 feet.]	Dark grey sands, with a harder vein from below 114 to 116 feet	20½	128½
	Harder dark grey sands	12	140½
	Green-coated flints	½	141
Chalk, with 10 inches of flints, below 147 feet; 6 inches, below 148; 4 inches, below 153½; a foot, below 173½, 177, and 181½; 6 inches, below 184; 9 inches, below 189½; 6 inches, below 198; a foot, below 199½; and 6 inches, below 205½ and 207½		68½	209½

As will be seen, there is some difficulty in fixing the divisions of the Eocene formations, and this was also the case in regard to the well at Glenny's Brewery (ESSEX NATURALIST, vol. vi., p. 48).

(47.) **Birchanger.**—*Blacklands.* 1895.

Made and communicated by Mr. G. Ingold.

Brown clay, with large flints [? Boulder Clay]		9	57 feet.
London Clay	Brown clay	4	
	Dark slate-coloured clay	44	

(47.) **Canfield, Great.**—*Helman's Cross.* 1893.

Made and communicated by Mr. G. Ingold.

Boulder Clay .... 11 feet.

(47.) **Chesterford, Great.**—"*The Elms*" *(a house by the cross-roads, at the eastern end of the village).* 1893.

Made and communicated by Mr. G. Ingold.

Chalk .... 46½ feet.

This is of interest, as contrasting with the following:

(47.) **Chesterford, Great.**—*A little northward of the church* 1894.

Boring made and communicated by Messrs. Tilley.

{Remarks in these brackets added from specimens.}

About 142 feet above Ordnance Datum.

Level of surface-water, in well, 25 feet down. Level of Chalk-water, 21·4 feet. (See Analysis at p. 183, *post.*)

		Thickness.	Depth.
Old well (the rest bored)		—	30
[Presumably all Glacial Drift.]	Rough ballast {stones of various sorts: chalk, flint, sandy limestone}	8	38
	Yellow running sand {brownish-grey, sharp, with chalk grains}	16	54
	Chalk-stones {pebbles of hard chalk} and flints	2	56
	Grey running sand {fine pale grey, with chalk grains}	12	68
	Chalk-stones {pebbles of hard chalk} and flints {a pebble of red chalk and a rolled piece of a large *gryphæa*}	2	70

		Thickness.	Depth.
[Presumably all Glacial Drift.]	Grey loamy sand {pale grey, fine, calcareous}	63½	... 133½
	Flints {clean gravel, mostly flint chips; some foreign stones; some small pebbles of hard chalk}	4½	... 138
	Brown clayey sand {pale grey, fine, calcareous}	3	... 141
	Yellow clay and chalk {pieces of chalk and fine, buff, calcareous, clayey sand}	5	... 146
	Red loamy sand {fine, light-brown, calcareous, compacted sand; some bits of chalk}	4	... 150
	Red sand {sharper, brown-grey, with chalk-grains}	6	... 156
White chalk		?	... ?

This section gives further evidence of the extension of the deep channel of Drift described in "Quart. Journ. Geol. Soc.," vol. xlvi., pp. 333-340 (1890) and ESSEX NATURALIST, vol. iii., pp. 140-42, and vol. iv., p. 117. The most northerly well noted in those papers is at Littlebury. The above is two miles farther north, and another well at Whittlesford, over three miles still farther, showing 62½ feet of Drift over the Chalk, also in the valley of the Cam and in Cambridgeshire, has been described in a Geological Survey Memoir ("The Geology of South-Western Norfolk and of Northern Cambridgeshire," 1893, p. 156).

(1, N.W.) Chingford.—*The "Bull and Crown."* Old well.

Communicated by Mr. T. Hay Wilson.

About 170 feet above Ordnance Datum. Said to be 275 feet deep, and always with about 30 feet of water, which was soft, and probably therefore not from the Chalk.

This well supplied the neighbouring part of Chingford, until the East London Company's water was laid on.

(1, N.W.) Chingford.—*Holly House, King's Head Hill.*

After 1874.

Communicated by Mr. A. Sheldon, through Mr. T. Hay Wilson.

About 90 feet above Ordnance Datum.

Shaft 80 feet. Bored 80 or 85.

Water rose to within 40 feet of the surface.

London Clay, pale bluish or slate-coloured. The last 10 feet through blue, brown, and yellow mottled clay into sand and black [flint] pebbles [? Basemen bed].

(47.) **Clavering.**—*Hill Green.* 1896.

Made and communicated by Mr. G. Ingold.
Water at 98 feet.

Blue Boulder clay	48	105 feet.
Chalk	57	

(47.) **Dunmow.**—*Keeper's Lodge, northern end of Bigod's Wood.* 1896.

Made and communicated by Mr. G. Ingold.

[Glacial Drift]	Brown [Boulder] clay	37	56 feet.
	Sand and gravel	19	

(47). **Elsenham.**

Four wells. Made and communicated by Mr. G. Ingold.

1. *Gants End. Keeper's House*, 1894.

Shaft 42½ feet, the rest bored.
Water rose to within 38 feet of the surface.

Soil		1	48
[Boulder Clay.]	Brown clay	17	
	Blue clay	30	

2. *Gants End. Half-a-mile S. of the Keeper's Lodge.* 1894.

Shaft throughout.
Water rose, from the bottom, to within 19 feet of the surface.

[Boulder Clay.]	Brown clay	10	39
	White clay	10	
	Hussick (a local term for layers of loose rubbly chalk, frequently found in the Boulder Clay, and which sometimes yield a good quantity of water)	1	
	Blue clay	18	

3. *Gants End. Sir W. Gilbey's Fruit Farm.* 1892.

Shaft throughout.

		Thickness.	Depth.
[Glacial Drift.]	Brown clay	19	19
	Blue clay	10	29
	Loose rubble	4	33
	Red sand	1	34
	White clay	6	40
	Blue clay, to sand	12	52

4. *Station Road.* 1894.

Water from the gravel.

		Thickness.	Depth.
	Soil	3	3
[Glacial Drift.]	Brown clay and stones	4	7
	Brickearth	4	11
	Gravel	5	15
	Sandy loam	3	19

(47.) **Farnham.**—*Perry's Farm, Farnham Green.* 1892.

Made and communicated by Mr. G. Ingold [and from specimens]. Shaft throughout. Water 119½ feet down.

		Thickness.	Depth.
Glacial Drift. ?	White clay	3	3
	Sandy loam	2	5
	Brown sand [specimen, from 5 feet, compact, fine]	1	6
	Clay [specimen, from 15 feet, brownish, slightly mottled grey]	12	18
	Dark sand	1	19
	Yellow loamy sand	2	21
	Brown clay [specimen, from 23 feet, light-brownish and grey, sandy]	6	27
Reading Beds; [the lowest two beds perhaps Thanet Sand.]	Yellow and grey sand, with ironstone [specimen, from 28 feet, loose fine light-brown; and a concretion of iron-sandstone]	2	29
	Mottled clay	6	35
	Yellow sandy loam [specimens, from 35 feet, very pale fine sand, partly stained with iron; from 37 feet, crimson brown and pale sand, concreted by iron]	6	41
	Dark green loam [specimen, from 41 feet, dull green fine compact sand]	3½	44½
Upper Chalk.	Flints	½	45
	Chalk with flints [specimens, from 45 and 100 feet, soft]	78	123

Mr. Ingold suggests that the clay beginning 6 feet down may be London Clay. If it be so that clay must rise up under the Drift, which is fairly thick on the high ground hereabouts. It is hard to make out the division between the Drift and the older Tertiary beds.

(47.) **Farnham.**—*The Rectory.* 1893.

Made and communicated by Mr. G. Ingold.
Water-level 19 feet down.

[Drift.] White Boulder clay	15	23 feet.
[Drift or Reading Beds.] Red sand	8	

(47.) Hatfield Broad Oak.

Three wells, made and communicated by Mr. G. Ingold.

1. *Cage End.* Boring. 1892.

[Glacial Drift.]	Brown Boulder clay	14	27 feet.
	Blue Boulder clay	13	

2. *Near The Grange. A mile E. of N. of Barrington Hall.* 1893.

[Glacial Drift.]	Light-brown Boulder clay	8	20 feet.
	Dark-brown Boulder clay	7	
	Loose chalky rubble	5	

3. *Taverner's Green.* 1896.

Light-brown Boulder clay	16	20 feet.
Loose rubbly chalk, with water	4	

(47.) Hatfield Heath. 1893.

Made and communicated by Mr. G. Ingold.

[Boulder Clay.]	Brown clay	21	23 feet.
	Blue clay	2	

(47.) Henham.—*Plegdon Hall Cottages.* 1896.

Made and communicated by Mr. G. Ingold.
Water at 14½ feet.

[Glacial Drift.]	Gravelly [Boulder] clay	7	17 feet.
	Yellow sand	10	

(1, S.W.) Ilford.—*Redbridge Cottage.* 1891.

Information from Messrs. Legrand & Sutcliffe, to Mr. Dalton.

		Thickness.	Depth
Dug well		—	20
Blue [London] clay		46	66
[? Blackheath or Woolwich Beds]	Dead grey sand, pebbles and shells	6	72
	Peaty sand and shells	2	74
[Woolwich Beds]	Black clay and shells	8	82
	Dead grey sand and shells	3½	85½
	Hard green sand	4½	90
	Greenish sand and pebbles	2½	92½

The ending off of the Woolwich Beds in this and in the Downhall well is somewhat doubtful.

This section seems to throw doubt on the figures given by Dr. Mitchell in that opposite Red House (see "Trans. E.F.C.," vol. iv., p.

158). Should these, however, be right, then Mr. Dalton is right in saying that "the proximity of the base of the London Clay, coupled with its being 300 feet close by, proves the correctness of the position assigned [by him] to the Roding Valley fault (in the map in THE ESSEX NATURALIST, vol. v., pl. iii.), a fault detected wholly by calculation, and now fixed within 100 yards limit of error."

(1, N.W.) **Laver, Little.**—*Envilles.* 1892.

Made and communicated by Mr. G. Ingold.

Shaft; slow spring.

[Glacial Drift.]	Brown Boulder Clay	15	20 feet.
	Blue " "	5	

(1, S.E.) **Leigh.** 1896.

Sunk and communicated by Mr. R. D. Batchelor.

Shaft 293 feet, the rest bored. Still in progress.

		Thickness.	Depth
[London Clay.]	Clay	17	17
	Black clay	20	37
	Clay with large boulders [septaria] ...	12	49
	Clay	34	83
	London clay	251	334
	London clay, with sand	25	359
[Blackheath Beds.]	Sand. Water, at 364 feet, rose to 100 feet from the surface	6½	365½
	Gravel [flint pebbles] and rock	14½	380
[? Woolwich Beds.]	Sand	40	420
	Clay and sand	20	440

(1, N.E.) **Mountnessing.**—*Tylhus, E. of Bacons, about a mile northward of the Hall.* 1895.

Under 300 feet above Ordnance Datum.

A boring communicated by Dr. J. C. Thresh.

One sample of the water contained 294 grains of chlorine to the gallon, another 301.

		ft.	in.
[Glacial Drift.]	Heavy [Boulder] Clay	5	6
	Sand [specimen coarse, brown, with small stones]	0	4
[? London] Clay		—	

1, N.W.) **Parndon, Great.**—"*Kingsmoor*" (*Mr. Todhunter's*).

Made and communicated by Messrs. A. Williams & Co.

Shaft 6 feet, the rest bored.

Water-level 50 feet down. Yield 300 gallons an hour.

		Thickness.	Depth.
[? Glacial Drift.]	Clay	6	6
	Clay and stones	8	14
	Brown clay and sand	16	30
	White sand and clay	20	50
	Gravel	16	66

(47.) Pentlow.—1895.

Made and communicated by Mr. G. Ingold.

Small supply of water at 18 feet.

		Thickness.	Depth.
[Boulder Clay.]	Yellow clay	11	11
	Chalky clay	7	18
	Brown clay	3	21
	Chalk [a boulder]	2	23
	Blue Boulder clay	7	30

(1, S.W.) Purfleet.—*Thames Paper Mills, formerly St. Louis Park Mills; south of the railway, less than half-a-mile eastward of the station.* Five wells.

At the marsh level, ? about 10 feet above Ordnance Datum.

1 has been published in "The Geology of London," vol. ii., p. 31 (1889). It is close to the railway, at the eastern end of the Company's ground.

2. *Near the railway, at the western end of the Company's land.*

Communicated by Mr. E. Reed, manager.

About 20,000 gallons of water [? per hour] got at full tide, less at low tide.

		Thickness.	Depth.
Soil		1	1
[Alluvium, 29 feet]	Peat and clay	9½	10½
	Ooze and mud	19½	30
Ballast [River Gravel]		20	50
Chalk, with salt water		200	250

The rest made and communicated by Mr. R. D. Batchelor, with some additions from Mr. Reed.

3. *About half way between 1 and 2.* 1891.

At 243 feet 5 gallons of water a minute, and little salt. Boring tested, at 268 feet 6 gallons a minute; at 368 feet about 90 gallons an hour; at 410 feet about 180 gallons an hour; at 443 feet about 30 gallons a minute, and salt. Mr. Reed notes that 1,200 gallons of fresh water an hour were got; that salt water was got in the first 200 feet of chalk, and fresh water in the last 100.

		Thickness.	Depth.
[Alluvium]	River mud	14	14
	Peat	13	27
[River Drift, 26 feet]	Gravel	16	43
	Gravel and chalk	10	53
[Upper (and ? Middle) Chalk, 401 feet.]	Chalk and flints, with a foot of rock 128 feet down	144	197
	Chalk and flints, very hard; a layer of dark chalk at 243 feet	53	250
	Chalk, the bottom 3 feet hard	17	267
	Sticky chalk, no flints	130	397
	Hard chalk	43	440
	Rock chalk	14	454

4. *Just east of the entrance road and just south of the high road.*

1892.

Pumped, with a pump of 7 inches diameter, for four or five hours, at the rate of 20,000 gallons an hour. Mr. Reed says that the bulk of the water came (in this and in 5) from between 50 and 75 feet down, from a bed of flints, and that the water was fresh and good.

		Thickness.	Depth.
[Alluvium]	Clay	10	10
[Upper Chalk.]	Chalk and flints	33	43
	Flints. Did not need shelling out: the stuff vanished somewhere, must be a pot-hole	17	60
	Chalk and flints	52	112

5. *Close to 4.* 1892.

Tested, with a pump of 7 inches diameter, at the rate of 101,000 gallons an hour, lowering the water-level 10 feet. Mr. Reed notes merely a trifle less, 2,422,224 gallons a day of twenty-four hours. Water fresh; hardness 38·7°.

[Alluvium.]	Clay	6	130
	Peat	3	
Chalk and flints		121	

(47.) Rayne.—*Rayne Hall.*

Sunk and communicated by Mr. G. Ingold.

[Glacial Drift.] Gravel and sand .... 17½ feet.

(47.) Sheering.

Two wells. Made and communicated by Mr. G. Ingold. 1894.

1. *Mr. Mann's Cottages.*

Shaft throughout. Water rose to within 28½ feet of the surface. Large quantities of air bubbled up through the water for several weeks. Analysis showed that it contained 71·95 vols. of carbonic acid in 10,000 (·7195 per cent.).

Soil		2	36½
[Boulder Clay]	White clay	3	
	Brown clay	31½	

2. *Mr. Silk's House.*

Shaft 36 feet, the rest bored.

Water from sandy veins in the clay.

Soil		3	43
[Boulder Clay]	Brown clay	17	
	Blue clay	23	

(2.) **Shoeburyness.**

Made and communicated by Mr. R. D. Batchelor. 1895.

Shaft 170 feet, the rest bored.

Water-level 76 feet down, lowered to 146¼ after 48 hours test-pumping.

		Thickness. ft.	Thickness. in.	Depth. ft.	Depth. in.
Mould		2	0	2	0
[River Drift, 20 feet.]	Brickearth	4	0	6	0
	Gravel, with water	1	6	7	6
	Gravel and sand	14	6	22	0
[London Clay, 396 feet.]	Brown clay	3	6	25	6
	Blue clay	3	0	28	6
	London Clay	21	6	50	0
	Sandy clay, with a little peat, very soft. Water (about 1,000 to 1,200 gallons an hour)	2	6	52	6
	Sand	8	6	61	0
	Gravel [flint pebbles ?]	1	1	62	1
	Clay	4	8	66	9
	London Clay	351	3	418	0
[Blackheath Beds, 37 feet. ?]	Loamy sand, with water	17	0	435	0
	Sand	11	0	446	0
	Greenish dead sand and a few pebbles	9	0	455	0
[Woolwich Beds, 20 feet.]	Black sand, dead and sticky	5	0	460	0
	Dark sand, almost black	10	0	470	0
	Dark peaty sand	3	0	473	0
	Dark clean sand	2	0	475	0

Judging by the section in THE ESSEX NATURALIST, vol. vi., p. 57 (1892), it is possible that the River Drift should be taken down to 62 feet, in which case the clays between that depth and 22 feet may represent the brickearth of Grays, etc., of the existence of which a trace was found in a railway-cutting near Rochford in 1887 (see "Geology of London and of Part of the Thames Valley," vol. i., p. 422).

(1, S.W.). **Silvertown.**—*Messrs. Brunner, Mond & Co., Crescent Wharf.*

Two wells. Made and communicated by Messrs. Isler & Co.

1. Water-level 10 feet down. Supply 6,000 gallons an hour.

		Thickness.	Depth.
Made ground and clay [Alluvium]		4	4
[River Drift, 36 feet.]	Ballast [gravel]	15	19
	Ballast and sand	3	22
	Ballast	18	40

2. Water-level 7 feet down. Supply 6,000 gallons an hour.

Made ground, peat and clay [Alluvium]		15	35
[River Gravel.]	Ballast	20	

(1, S.E.). **Stanford-le-Hope.**—*Broad Hope Farm, a mile south of east from the church.* 1895.

Bored and communicated by Mr. R. D. Batchelor.

Water-level 31 feet down, lowered 7 feet after pumping all day. Supply tested to 720 gallons an hour.

		Thickness.		Depth.	
		ft.	in.	ft.	in.
Old well [Gravel and London Clay?], the rest bored		—	—	22	0
[London Clay.]	Clay	45	0	67	0
	Clay and sand	5	0	72	0
[? Blackheath Beds, 49⅔ feet.]	Sand	5	0	77	0
	Sand and black [flint] pebbles	5	0	82	0
	Thanet sand and black [flint] pebbles	5	6	87	6
	Sand, etc.	8	6	96	0
	Gravel [flint pebbles] and sand	10	8	106	8
	Gravel [flint pebbles]	5	0	111	8
	Sand	2	0	113	8
	Sand and gravel [flint pebbles]	8	0	121	8
[Woolwich Beds, 33½ feet.]	Dark sand and clay	6	0	127	8
	Dark sand	12	6	140	2
	Sand and gravel [flint pebbles]	15	0	155	2
[Thanet Sand, 64 feet.]	Dark sand	12	0	167	2
	Sand	34	0	201	2
	Dark sand	18	0	219	2
Chalk		55	10	275	0

This section seems to show the Oldhaven or Blackheath Beds in unexpected force, greatly at the expense of the Woolwich Beds.

(47). Stanstead Montfitchet.

Two wells, made and communicated by Mr. G. Ingold.

1. 50 *yards S. of the Railway Station.* 1893.

Shaft 31 feet, the rest bored.

		Thickness.	Depth.
[Glacial Drift]	Gravel	52	52
	Sand	2	54
	Gravel	8	62
[? Reading Beds.]	Brown loam	4	66
	Blue clay	5	71
	Brown loamy sand	2	73
	Stones	½	73½
Chalk		78½	152

No. 2. "Woodfield." 1893.

Water at 57½ feet from the surface.

[Glacial Drift.]	Gravel	49	59½ feet.
Chalk		10½	

1, S.W.) Stratford.—*Messrs. Howard & Sons' Chemical Works; Second Boring.* 1885, 1886.

Made and communicated by Messrs. Legrand & Sutcliff (to Mr. Dalton, who gives particulars of position).

60 feet north and 572 west of St. Michael's Bridge. 308 feet west of first well. Water-level 33 feet down, February, 1886.

		Thickness.	Depth.
Dug well		—	13
[River Drift.]	Sandy clay	3	16
	Ballast [gravel]	6	22
Blue [London] Clay, with 6 inches septaria (?) at the base		12½	34½
[Woolwich and Reading Beds, 47½ feet.]	Coloured [mottled] clay	9½	44
	Light[-coloured] dead grey and brown sand and clay	6	50
	Blue clay and shells	12	62
	Coloured [mottled] sandy clay and stones	7½	69½
	Black pebbles	2	71½
	Grey sand and clay	7½	79
	Grey sand, clay, shells, and pebbles	3	82
[Thanet Sand, 52½ feet.]	Hard dark sand and clay	9	91
	Hard dead grey sand	43	134
	Flints	½	134½
Chalk and flints		117	251½

(1, S.W.) Stratford.—*Temple Mill Lane. Messrs. Clay & Co.*

Bored and communicated by Messrs. Isler & Co.

Water-level 19 feet down. Supply 1,000 gallons an hour.

		Thickness.	Depth
Dug well (ballast), the rest a bore of 4 inches diameter		—	14
[Woolwich Beds, 37 feet.]	Blue clay	12	26
	Green sand and clay	13	39
	Fine dark sand	5	44
	Shingle and sand	7	51
[Thanet Sand.]	Fine sand	3	54
	Blowing sand	44	98
Chalk and flints		166½	264½

This section is in the part where, from uprise of the beds, the London Clay has been eroded.

(47.) **Strethall.**—*The Hall.* 1892. *Deepened* 7 *feet,* 1894.

Made and communicated by Mr. G. Ingold.

Shaft throughout.

Blue Boulder Clay	31	200½
Chalk, with layers of clunch at the depth of 115-117½ and of 126-131½	169½	

(1, S.W.) **Thurrock, West.**—*Tunnel Cement Works.* 1876.

Made and communicated by Messrs. Legrand & Sutcliff.

Water-level 10 feet down. ? Yield 220,000 gallons a day, of 10 hours, from 2 tube-wells.

Chalk and flints	71 feet

Waltham Abbey.

The following is from a Memorandum as to artesian wells on the property of the War Department, Waltham Abbey, by Major F. Edmondes, R.E., February, 1886, and though no section of the wells is given the particulars are of interest.

The water of the dwelling-houses of the officers and hands of the factory is from a well at the back of the Gun-cotton Works. This well was in existence when this part of the factory was acquired, and its exact depth is not known. ? 100 feet, or more.

It has given a continual supply equal to requirements for the last twenty-five years. After exceptional seasons of drought the supply lessens. It is said that twenty years ago the delivery was 5 feet above ground; now it is only 1½.

The well in Powder Mill Lane became silted up, and was rebored ten or twelve years ago. It was cleared to a depth of 95 feet, and the supply has since been continuous.

The water (? of both wells) flows into tanks at ground-level, and from these is pumped into high-level tanks, for pressure.

(1, N.W.) **Waltham Abbey (Sewardstone).**—*Spencer's Farm, a few years before* 1874.

Communicated by Mr. A. Sheldon, through Mr. T. Hay Wilson. About 47 feet above Ordnance Datum. Sunk and bored 80 feet. In 1874 water rose just to the surface. [? From just below the London Clay.]

(1, S.W.) **Walthamstow.**—*Essex Brewery, near St James' Street Station. Two Wells.*

"Epping Forest" . . . by F. Collier, undated (? soon after 1880), pp. 31, 32.

Supply from two sources, both copious. One from the beds next below the London Clay, at the depth of 90 feet, soft and used for cooling, washing, etc. The other from 180 feet down in the Chalk, used for brewing only.

	Thickness.	Depth.
[River Drift] Gravel	11	11
London Clay	81	92
Woolwich Beds	29	121
Thanet Sand	61	182
Chalk	180	362

Messrs. Collier have written to me, however, in 1893, that, the water-level having dropped from 30 feet to 50 feet down, a second well was sunk in 1892, about 30 feet from the older one.

This was made by Messrs. Baker, who have contributed the following particulars.

Shaft 111 feet, the rest bored.

Water-level 48 feet down. Continuous pumping, with a pump of 8 inches diameter, lowered the water only 11 feet.

			Thickness.	Depth.
Mould			3	3
[River Gravel.] Rough Ballast			10	13
[London Clay, 101 feet.]	Brown clay		57	70
	Petrified timber		1	71
	Brown clay		18	89
	Mottled clay		21	110
	[Basement-bed.]	Pebbles	1	111
		Septaria	2	113
		Shelly bed	1	114
[Reading Beds, 38 feet.]	Brown sand and white marl		7	121
	Dark loam		17	138
	Sand and pebbles		8	146
	Dark sandy clay		6	152
[Thanet Sand, 28 feet.]	Thanet Sand		27	179
	Green-coated flints		1	180
Chalk			186	366

ANALYSES OF WATERS FROM WELLS AND SPRINGS.

The following analyses are given as in the originals, sometimes with slight condensation. It is a pity that chemists do not agree on one system of stating facts, so that analyses should be more readily comparable.

Some of the analyses are only partial, as, for most purposes, purity from organic matter is the chief quality to be determined For geologic purposes a complete analysis is wanted, and to understand a water thoroughly of course it is needful to have details of the mineral contents.

The Geological Survey Memoirs, or the Papers in which accounts of the wells have been given, are noted.

For a mass of information on this subject (chiefly relating to shallow wells) the reader is referred to the "Report on the Water Supplies of the Various Villages and Hamlets in the Chelmsford and Malden Rural Sanitary Districts," by Dr. J. C. Thresh, 8vo, *Chelmsford*, pp. xii., 51. Price 6d. (1891). Other published analyses are as follows:

Bocking, Messrs. Courtauld's. "Rep. Brit. Assoc." for 1883, p. 156. *Braintree*, Local Board. *Ibid.* for 1887, p. 361.

Monkham Park. "Geology of London," etc., vol. ii., p. 28.

Southend, Waterworks. G. W. Wigner's "Water Supply of Seaside Watering Places."

Thames Haven. "Trans. San. Inst.," vol. i.

"The Shallow and Deep Well-Waters of Essex," Dr. J. C. Thresh. THE ESSEX NATURALIST, vol. vii. (1893), pp. 28–40.

(1, S.W.) Barking, *Mills*.

Deep well into Chalk. See "Geology of London," etc., vol. ii. p. 13. By Mr. G. W. Wigner, 1878.

Physical Characteristics.

Colour, in two feet tube, opaque yellow.
Organic matter, slight traces. Suspended matter [? ditto].
Smell, when heated to 100° F., satisfactory.
Taste, " " good.
Hardness before boiling 5·2° ; after boiling 2·3°.

Chemical Results, in grains per gallon.

Total solid matter	32·3
Loss on ignition	1·5
Total mineral matter	30·8
Chlorine (calculated as chloride of sodium)	6·65
Iron, trace	—
Alkaline salts	18·02
Nitrogen as ammonia	·0312
,, ,, albumenoid ammonia	·0036
,, ,, nitrates	·0150
,, ,, nitrites, trace	—
Oxygen absorbed by organic matter	·002

Regarded as a first-class water.

(2.) **Burnham**, *Waterworks (well); and* **Southminster**, *Public Pump.*

Communicated by Mr. W. T. Foxlee.

In parts per 100,000.

	Burnham.	Southminster.
Chlorine as chlorides	5·	3·1
Nitrogen as nitrates	1·13	1·68
Oxygen required to oxidise organic matter	—	·07
Saline ammonia	·002	·001
Organic ammonia	·004	·01
Sulphuric anhydride as sulphates	4·8	—
Total solids	43·	44
Hardness before boiling	21°	17°
,, after ,,	11·7°	—

Very similar waters, but the Southminster sample containing more organic matter.

(47.) Chesterford, Great.

Well described above, p. 169 (through deep Drift to Chalk).

Communicated by Messrs. Tilley.

By Professor J. Attfield, 1894. In grains per gallon.

Total suspended solid matter, dried at 250° F.	2·
,, dissolved ,, ,, ,, ,, ,,	29·
Ammoniacal matter, yielding 10 per cent. of nitrogen (= ammonia per million, ·008)	·005
Albumenoid organic matter and nitrites, none	—
Nitrates containing 17 per cent of nitrogen (= nitrogen ·123)	·74
Chlorides, containing 60 per cent. of chlorine (= chlorine 1·2)	2·
Oxygen absorbed in three hours	·001

Hardness, removed by boiling 17°, not removed 6°, tota 23°.

There was a slight chalky sediment.

This water is remarkably free from contamination by organic matter. It contains much inorganic (mineral) matter that gives hardness. It is of good quality for drinking-purposes.

(48, S.W.) **Donyland, East.**—*Steam Brewery.*

Deep well into Chalk. See "Geology of the Neighbourhood of Colchester," p. 17 (entered under "Rowhedge").

By Mr. R. T. Daniell. Communicated by Mr. P. Bruff, C.E 1883.

Qualitative Analysis.

Free ammonia	·88 per million
Albumenoid ammonia	·10 „ „
Temporary hardness	6 degrees
Permanent „	6 „
Total solids	86·5 grains per gallon

Quantitative Analysis in grains per gallon.

Chloride of sodium	55·998
Carbonate of magnesia	4·873
„ „ lime	3·393
„ „ soda	14·840
Sulphate of soda	6·327
Silica	trace
Loss on analysis, and organic matter	1·069
	86·5

(47.) **Felstead.**—*The School.*

Deep well to Chalk. See "Trans. Essex Field Club," vol. iv., p. 156. By Prof. Liveing. Communicated by Mr. D. S. Ingram. In parts per 100,000.

Free ammonia	·079
Albumenoid ammonia	·0017
Carbonate of lime	4·37
Carbonate of magnesia	3·15
Carbonate of soda	26·48
Sulphate of soda	14·29
Sulphate of potash	2·56
Sodium chloride	47·45
Mineral constituents, besides traces of silica	98·37

Hardness: temporary, 3·65° ; permanent, 1·6° ; total, 5·25°.

It is possible that some of the alkaline sulphates above given should have been reckoned as carbonates, and an equivalent quantity of earthy carbonates as sulphates.

(1, N.E.) **Maldon.**—*Ballast-pit in the fork, next Railway Station.*

By Dr. P. F. Frankland, July, 1889. In parts per 100,000.

Total solid matters	54·73
Albumenoid ammonia	·019
Ammonia	—
Chlorine	13·1

Hardness, temporary 10°, permanent 7·1°, total 17·1°.
Turbid, palatable.

(1, N.E.) **Maldon.**—*Waterworks.*

Deep well through London Clay. See "The Geology of London," etc., vol. ii., p. 26.

By Dr. J. Whitmore. Communicated by Mr. W. T. Foxlee. In grains per gallon.

Total solid matter	78·4	
Loss by incineration at a dull red heat	1·04	
Chlorine (equal to chloride of sodium 42·35)	25·7	
Nitrogen as nitrates and nitrites	·069	
Oxygen required for oxidizable matter	·0215	
Estimated organic matter	·162	
Free ammonia	·088	in parts per 100,000.
Albumenoid ammonia	·0022	

Hardness before boiling 3·7°, after boiling fifteen minutes, none.

Manuden.

Boring 200 feet, 120 in soft chalk. Made by Mr. J. W. Knights, of Cambridge. Communicated by Mr. G. Ingold. Grains per gallon.

Total solid matters	29·
Chlorides (as NaCl)	3·63
Free ammonia	·0588
Albumenoid ammonia	·0007
Oxygen absorbed by organic matter in 15 minutes	·01
" " " 4 hours	·027

No nitrates or phosphates.
Appearance in 2 feet tube, turbid, reddish brown.
No smell when heated to 100° F.
Contains oxide of iron.

(48, S.W.) **Mersea, East.**

Deep well to Chalk. See "The Geology of the Country around Ipswich," etc., p. 109. By Professor J. Attfield. June, 1883.

The water is free from any serious contamination by animal or vegetable matter. It contains a good deal of salt; indeed it appears to contain some sea-water.

It is difficult to say how much salt is enough to make drinking-water injurious. There is no more salt in a gallon of this water than a person would commonly take at dinner.

In grains per gallon :

Total solid matter, dried at 212° F.	128·
Ammoniacal matter, yielding 10 per cent. of nitrogen (equal to ammonia per million, ·7)	·4
Albumenoid organic matter, yielding 10 per cent of nitrogen (equal to ammonia per million, ·07)	·04
Nitrates [? Nitrites] containing 7 per cent. of nitrogen (equal to nitrogen ·07 grains)	·4
Chlorides, containing 60 per cent. of chlorine (equal to chlorine, 49)	82·

Hardness, removed by ebullition 10°, unaffected, 1°, total 11°.

(48, N.W.) **Mistley.**—*On the property of Mr. R. Ince.*

Deep well into Chalk. See ESSEX NATURALIST, vol. vi., p. 54.

Communicated by Messrs. Free, Rodwell & Co., 1891.

By Mr. F. Sutton. In grains per gallon.

Ammonia, free	·045
Ammonia, organic	·007
Chlorine	12·18
Nitrogen as nitrates, trace only	—
Oxygen required	·02
Lime	3·136
Magnesia	2·57
Sulphuric anhydride	4·38
Organic carbon	·163
Organic nitrogen	·039
Total solids in solution..	46·83

Hardness before boiling 10·8°, after boiling 1·3°.
Microscopic examination, colour, etc., satisfactory.

The water is in almost all respects satisfactory. The organic impurity is very low. The free ammonia, though rather high, is of no practical consequence, and is common to all deep springs. The only weak point is the salt represented by the chlorine.

(1, S.E.) **Mucking.**—*Waterworks at Muckingford.*

Well into Chalk. See "The Geology of London," etc., vol. ii., p. 28. By Messrs. Corbyn, Stacey & Co.

Without perceptible colour, taste, or odour. Perfectly bright and clear, and nearly free from suspended matter. Reaction faintly alkaline.

Total solid matters, 24 grains per gallon.
Chlorine .. .. 1·9 " " "
Albumenoid ammonia practically absent.
No free ammonia, nitrites, or nitrates.

Microscopic examination showed only the presence of a few particles of dust. A first-class water.

(47.) **Newport.**—*Shortgrove.*

Two wells. Communicated by Mr. G. Ingold. By Mr. J. W. Knights, of Cambridge, 1893 and 1894 respectively. In grains per gallon.

(1.) *Bromleys.* From a well 10 feet deep in gravel. About 60 feet above the stream. A good supply of water.

(2.) *Newport Lodge.* From a well 10 feet deep in gravel.

	(1.)		(2.)
Total solid matter	27·	...	38·
Chlorides (= common salt, NaCl, 2·14) ...	1·3	...	2·8 (as NaCl)
Nitrates, expressed as nitrogen	1·5	...	·5
Free ammonia	·0077	...	·0007
Albumenoid ammonia	·0035	...	·0014
Oxygen absorbed by organic matter in 15 minutes, at 140° Fahr.	·0224	...	·0336
Appearance in 2 foot tube, clear, pale blue	In both.		
Smell when heated to 100° Fahr., none			
Microscopic examination, no deposit			

(47.) **Newport.**—*From Springs in rear of the Grammar School.*

By Mr. J. W. Knights, of Cambridge. 1887.

	(1.)		(2.)
Total solid matter	29·	...	28·
Chlorides (as NaCl)	2·31	...	2·14
Nitrates (as nitrogen)	·05	...	·08
Phosphates	trace	...	trace
No free ammonia. Albumenoid ammonia ...	·0007	...	·0007
Oxygen absorbed by organic matter in 15 minutes	·006	...	·008
Oxygen absorbed by organic matter in four hours	·014	...	·018
Appearance in 2 foot tube	clear	...	pale blue
No smell when heated to 100° Fahr.			

(2.) **South Shoebury.**—*Less than half-a-mile N.E. of St. Andrew's Church.*

Sample taken when the boring was 844 feet deep [in Chalk]. See ESSEX NATURALIST, vol. vi., pp. 56-58. By Prof. J. L. Notter, 1889. Sample drawn, December, 1888.

Physical Characters.

Slightly yellow. Turbid. Sediment very large. Lustre dull. Taste nauseous. No smell.

Hardness, in parts per 100,000, fixed 4, removable 1, total 5.

Qualitative Examination (so far as not given below).

Magnesia, trace. Sulphuric acid, large. Oxidizable matter, trace.

Quantitative Examination, in parts per 100,000.

	Volatile matter	10·
	Chlorine	26·5
	Calcium carbonate	·6666
	Fixed hard salts	4·
	Sulphuric acid (SO_4)	58·8334
	Alkaline carbonates	
	Sodium or other metal (combined with Cl or SO_4, not included in fixed hard salts)	
	Silica, alumina, iron, etc.	
	Total solids, by evaporation	100·
	Oxygen required for organic matter	·128
These, with the oxidizable organic matter, are included in the Volatile Matter.	Free ammonia	·0453
	Albumenoid ammonia	·0052
	Nitric acid (NO_3) [No nitrous acid]	·313
	Total nitrogen included in nitrites and nitrates	·3003

Microscopic Examination.

Amorphous granular mineral matter and a few minute infusoria.

Bacteria Experiments.

Liquefaction after 6 days: very extensive after 9 days, increasing slowly.

This water contains an excess of chlorine, of total solids and of free ammonia. The small amount of hardness is against its being contaminated by sea-water. The organic matter is due possibly to the nitrogenous matter in the strata, and if so is harmless. The water may be used for drinking-purposes after filtration.

(47.) **Stanstead.**

Boring 152 feet, in soft chalk.

Made by Mr. J. W. Knights, of Cambridge. Communicated by Mr. G. Ingold. Grains per gallon.

Total solid matter	34·
Chlorides (as NaCl)	4·44
Free ammonia	·0476
Albumenoid ammonia	·0035
Oxygen absorbed by organic matter at 140° Fahr.	·056

Appearance in 2 feet tube, turbid, yellowish.
No smell when heated to 100° Fahr.
Much deposit of oxide of iron.

(48, S.W.) **West Bergholt.**—*Brewery.*

Deep well to Chalk. See "The Geology of Colchester," p. 18. By Mr. R. T. Daniell, 1881. Communicated by Mr. P. Bruff.

Qualitative.

Total solids	80·5	grains per gallon.
Free ammonia	·12	per million.
Albumenoid ammonia	·18	„ „
Chlorine	25·85	grains per gallon.

Hardness, 10 degrees, after 15 minutes boiling, 5·6 degrees.

Quantitative.

Chloride of sodium	42·574
Carbonate of soda	15·9
Sulphate of soda	10·83
Carbonate of lime	6·05
„ „ magnesia	2·535
Silica	1·75
Alumina, oxide of iron, etc.	·35
Organic matter, and loss in analysis	·511
	80·5

(47.) Wickham Bishop.—*Asylum.*

Deep boring into Chalk. See "Trans. Essex Field Club," vol. iv., pp. 168, 169.

By Prof. C. M. Tidy, January, 1880. In grains per gallon.

Total solid matter	133·15
Ammonia	·001
Nitrogen as nitrates and nitrites (= Nitric acid ·54)	·12
Oxygen required to oxidize the organic matter	·011
Lime (CaO)	2·74
Magnesia (MgO)	1·621
Sulphuric anhydride (SO_3)	8·66
Chlorine (=common salt 85·904)	52·416

Organic carbon, parts per 100,000	·054
„ nitrogen „ „	·026

Hardness, before boiling 3·3°, after boiling ·8°.

Of the 133·15 grains of solid matter nearly 86 were common salt. The organic matter is very small, and the water, as regards this, is very pure.

The quantity of solid matter is enormous, whilst the salt present shows that the water is "unusual" (*sic* in Dr. Tidy's MS.). The last is no indication of organic impurity.

As far as wholesomeness is concerned, the water is free from any suspicion, but it is a question whether it would be palatable. As regards ordinary detergent purposes it is well-fitted in every respect.

(47.) Wickham Bishop.

1. From a Well in Railway-cutting southward of Wickham Bishop Railway Station.

2. *From a Spring in the Cutting.*

By Dr. P. F. Frankland, July, 1889. Communicated by Mr. W. T. Foxlee.

In parts per 100,000.

	1.	2.
Total solid matter	29·28	30·12
Organic carbon	·088	·16
Organic nitrogen	·012	·036
Ammonia	·001	—
Nitrogen as nitrates and nitrites	1·029	·973
Total combined nitrogen	1·042	1·009
Chlorine	2·5	2·5
Temporary hardness	9·8°	9·4°
Permanent ,,	5·1°	4·9°
Total ,,	14·9°	14·3°

Slightly turbid; palatable.

AN EPISODE IN THE HISTORY OF THE RIVER LEA.

By W. C. WALLER, M.A, F.S.A. (*Hon. Treasurer*).

[*Read at the Field Meeting on the Lea, June 27th, 1896.*]

AMONG that wonderful collection of documents known as the State Papers (Domestic Series), is one[1] to which my attention was directed some long time ago by my acute and ever-helpful friend, Mr. G. H. Overend, of the Public Record Office. I made a note of it then, and now propose to put before you a brief narrative derived from a full transcript which I have made within the past two days. I mention the time that you may excuse my not having worked the matter out more in detail before bringing it forward. With these few prefatory remarks let us pass back into the "spacious times of great Elizabeth."

On March 6th, in the year 1594, Sir John Popham, then L.C.J., and Sir Edmond Anderson, L.C.J. of the Common Pleas, sat at Serjeants' Inn, in Fleet street, to hear proofs for the rights of the passage with barges on the river of "Ley" from Ware to the Thames, with the usage thereof for nearly twenty years then last past.

The origin of this solemn sitting is to be sought in a riot committed at a lock and bridge, known respectively as the Old Lock, or the Nether Lock, and the High Bridge, which latter was riotously thrown down. In our present document the Plaintiffs are concerned to maintain, as against the Defendants (and neither the one nor the other is anywhere named), that the great river running close to the town of Waltham is the ancient, navigable river Lea, one of the greatest of the realm. And they, thereupon, cite a Commission of 1355, which states that the river runs from Ware to Waltham Holy Cross; and that another stream, which the defendants allege to be the ancient river, was then but a ditch running to Cheshunt Mill, 16 feet wide, and represented by an Essex jury to be a hurt to the river Lea itself, inasmuch as it diminished the water supply in it. The mouth of the mill-dam was also represented by a Herts jury as 16 feet wider than it used to be. And this double presentment, by two counties, warrants the conclusion that the River Lea itself, and not the mill-stream, divides them. In 1482 the Abbot of Waltham is said to have a 16-foot way out of the river where he should have a 4-foot way only, and a 16-foot lock where he should have one of 18 feet, "for which cause it must be broken up, for it is great jeopardy to all manner of barges and boats upon the water there." The High Bridge, also, was reported to be a hindrance, owing to its lowness; in consequence of which passengers had to pay for having it drawn up, and there was like to "grow a duty and a charge" to them, "whereas there oweth no such to be."

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[1] S.P.D. Eliz. 248, fos. 265-270.

The defendants were concerned to make out that Smalleybridge, or Smallingbridge, elsewhere called Small Leigh Bridge, was what was meant by the High Bridge, which, in spite of its name, was the lower of the two; and that Cheshunt Mill Stream was the real ancient river Lea, and the boundary between the two counties. The contention seems, so far as one can gather, to have been a very ill-founded one, for the plaintiffs are able to allege that Smalleybridge was always so called and that the stream under it was but a shallow narrow ditch, obstructed by the mill-dam in such a way that not even a little vessel could pass that way.

Again in 1575 another Commission reported that the river ran from Ware to Waltham; from Waltham to Temple Bridge; from Temple Bridge to Bullyfant; thence to Clobbes Hill, the Old Ford, Bow Bridge, the Lock, Ley Mouth, and so to the Thames. We also learn that the lord of Theobalds paid 26s. 8d. to the lord of Perryors for a course of water going through his grounds from the Ley to Cheshunt Mill, till both manors came to my Lord Treasurer;

and that the Old Lock was about three-quarters of a mile beyond Waltham, and had been stopped up by force, Sir Edward Dening having recently made a new one.

Another Inquisition, dated 1512, gives the boundaries of the Abbot's manor of Waltham. It extended from Smalleigh Bridge, on the borders of the counties of Essex and Herts, along a small stream there called the Smalleigh, which is of the west part at the end of Waltham Common Marsh, to the meadow called Frithey, of which thirty-four acres lie in Cheshunt and sixty-four acres in Waltham, divided by a small lake, called the Sherelake, which is on the borders of Essex and Herts, half of it being in one and half in the other. Thence the manor extends northwards to Slatysholme ditch, which divides Hallifield Marsh in Essex and the meadow called Stratissholme in county Herts; so the same manor extends along (*per*) the lake to the great river called the High Leigh by Woodhey Shelpe, a place well known to be in the main navigable river, and along the river to Nasing Manor. Moreover, one, William Bedell, Esq., had diverted the water of the Abbot to his mill at Cheshunt more than he ought, to the damage of the king and his lieges passing in their boats.

The summary of these Commissions ends with the expression of a hope that the proofs "may suffice to satisfy Sir Edw^{d} Denny," and "move him to desist from these wrongs and yield to right." But the upshot of the whole matter remains to seek, and it is quite possible that the search may prove a long, and perhaps, after all, a futile one. However, I hope to return to it later, nor will I fail to communicate the results to the members of the Club.

The document has, by way of pendant, a note touching certain vessels called "shoutes," which were proved of ancient times to have passed down the river, but alleged to have been small. In answer to this, it is said that in Edward III.'s time three carried twelve load of timber, or four tons a piece; and in Henry IV.'s time one carried twelve tons. The barges, too, in recent times, were of six or seven tons burthen. The question of riparian rights is also touched on, and Bracton is cited to show that by the *jus gentium* the use of the banks is public, as are the rivers themselves. It appeared, also, that in Edward IV.'s time the owners of the land on either side were expected to take away all trees, bushes, and hedges growing upon the banks, and that similar duties had recently been enjoined on them, together with the making of bridges over mill-streams for the bargemen's use.

I owe my hearers an apology for the haphazard way in which these notes from the transcript are thrown together; but time has failed me to-day to do more. My hope is that we may get some identification of the ancient sites mentioned.

NOTES ON THE ANCIENT PHYSIOGRAPHY OF SOUTH ESSEX.[1]

(With Map shaded to show the Physical Geography of South Essex).

By T. V. HOLMES, F.G.S., M.A.I. (*Permanent Vice-President*).

IN a paper read before the Geological Society in 1894, and published in "The Quart. Jour. Geol. Soc.," August, 1894, entitled, "Further Notes on some Sections on the New Railway from Romford to Upminster, and on the Relations of the Thames Valley Beds to the Boulder Clay," I dwelt, *inter alia*, on the fragment of an ancient silted-up stream-course of considerable size, seen in a cutting at Romford.[2] This old stream-course had eroded a hollow on the surface of the London Clay, and was covered by gravel belonging to the highest, and presumably oldest, terrace of the present Thames Valley system. The material filling up this ancient stream-course appeared to have been largely derived from the Boulder Clay, small pebbles of Chalk being not uncommon. The rest of the deposit consisted of dark silt, with interbedded sand and small pebbles, chiefly flint. A considerable mass of Boulder Clay appeared in another part of the same cutting, but farther southward, and the relations between it and the old stream-course could not be seen, though (as in the Hornchurch cutting) the Boulder Clay rested upon the London Clay, and was covered by Thames Valley gravel. The course of the old stream appeared to have been about east and west, but its limits were clearly seen only on one side of the cutting. It was evidently older than the gravel belonging to the Thames Valley system, during the deposition of which most of it had been eroded away, and which was seen overlying the fragment preserved. I also pointed out that while the Boulder Clay, as a general rule, is only to be found at heights of 200 ft. or more above the sea in the immediate district, yet that it appears here and there at lesser elevations in the valleys of the Roding and the Ingrebourne, as well as on the new railway at Hornchurch and Romford. And that it descends to still lower levels in the valleys of the various streams around Chelmsford, which unite to form the Blackwater below that town. It was evident, therefore, that the valleys of the streams just mentioned must have been excavated to some extent before the deposition of the Boulder Clay. And that they belonged to another system than that of the present Thames, the oldest gravel of which had been found in the district around Romford, overlying the Boulder Clay.

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[1] A paper read at the Ipswich meeting of the British Association, with some slight additions.

[2] See also ESSEX NAT., vol. vii., pp. 1-14,—"The New Railway between Upminster and Romford. Boulder-Clay beneath Old River Gravel at Hornchurch—Conclusions therefrom," with map and section.

As regards the course taken by the stream, a fragment of whose silted-up bed was seen at Romford, I pointed out that it flowed probably between Warley, Billericay, and Maldon, on the north and west, and Laindon (or Langdon) Hill, Rayleigh, and Althorne, on the south and east, into the valley of the Blackwater below Maldon. I propose to consider more fully on this occasion the evidence bearing upon the ancient river-systems of South Essex.

If we look at the map of the Geological Survey, with the view of learning something about the physiography of South Essex from the distribution of the various geological formations found therein, we obtain the following information: We find that the Bagshot outliers, certain high-level gravels, and the Glacial gravel and Boulder Clay (all beds to be found only at comparatively high levels) exist mainly north of a line drawn through Chigwell to Havering-atte-Bower and thence about two miles south of Brentwood and Billericay through Woodham Ferris to Maldon: South and east of that line we have a belt of country the surface of which consists of London Clay, above which, towards its southern margin, rise outlying patches of Bagshot Beds and high-lying gravel at Laindon Hill and around Rayleigh. Then, mainly south of a line drawn from Barking Side through Romford, N. Ockenden, Stanford-le-hope, and Pitsea, lie the gravel, brick-earth, and alluvium of the Thames Valley; while east and north-east of Pitsea, from Leigh and Southend to the mouth of the Blackwater at Bradwell, similar beds of gravel, brick-earth, and alluvium occupy a considerable belt of ground between Rochford, Canewdon, Burnham, Southminster, Tillingham, and Bradwell on the west, and the sea on the east.

From the distribution of these various deposits the geologist would rightly infer that there was high ground at and north of Havering-atte-Bower, Brentwood, Billericay, Woodham Ferris, and

Maldon, and a belt of comparatively low ground southward and eastward of those places. He would also be right in supposing that at Laindon Hill and around Rayleigh there were isolated patches of high ground, and that there was much low-lying flat ground towards the margins of the Thames and of the sea. He would note, besides, the existence of an alluvial flat of considerable size, north of Stifford, on the borders of the little stream called the Mardyke, and of another, of much greater breadth, on the banks of the river Crouch, east of Burnham and Canewdon.

But though, owing to the fact that the various formations of South Essex are lying nearly flat, the geological map indicates the general configuration of the present surface of the ground, it will shortly be seen that it omits much of the utmost importance if we desire light on the ancient river systems of the district. For that purpose we must compare the information afforded by the geological map with that to be obtained from another coloured or shaded so as to show the present physical geography of South Essex. Such a map is published with the present paper.

I have already pointed out that the deposits of gravel and loam which range from Romford to Upminster, and thence by North and South Ockendon to Stifford, Stanford-le-hope, and Fobbing, belong to the present Thames Valley system. Between Fobbing and Leigh, about Pitsea, the Thames in its meanderings has eroded away its older deposits, and left in their place the more modern alluvium of Canvey Island and the marshes eastward of it. At Leigh and Southend, however, beds of gravel and loam, resembling those seen from Fobbing westward, again appear (as before stated) and range thence to Canewdon, Burnham, Southminster, and Bradwell. Mr. Whitaker, in his Memoir on "The Geology of London and Part of the Thames Valley" (vol. i., p. 476) has expressed an opinion that these beds were formed on the western flank of the ancient valley of the Thames when the right, or eastern, bank of that river existed where now there is open sea. And I think there can be little, if any, doubt of the correctness of this determination. Thus the deposits belonging to the Thames Valley system in Essex lie close to or within a short distance of the Thames from Southend westward, and on the Essex seaboard between Southend and Bradwell.

The maps giving us geological information about Essex are those of the older Ordnance Survey, and have no contour lines on them; while those of the newer Ordnance Survey have contour lines which are only visible on close inspection. Consequently, a glance at one of the latter maps gives us much less information about the physical geography of the district than would be obtainable either from the geological map, or from the shaded maps of the older Ordnance Survey. It is necessary, therefore, to colour or shade the New Ordnance map if we wish to get the most complete knowledge of the present shape of the ground, and the trouble involved in doing so is amply repaid by the result attained. We then see revealed very strikingly the existence of a broad continuous tract of low ground from Romford eastward to the Blackwater below Maldon. This low ground is bounded on the north and west by a perfectly continuous tract of higher land, towards the edge of which are Warley, Billericay, Woodham Ferris, and Maldon. South-east of the belt of lowland we see another belt of high ground, ranging in a direction nearly parallel with that first mentioned, but not so continuous, from Laindon Hill to Rayleigh and Canewdon, and thence, north of the Crouch, to Althorne and Mayland. And, though the continuity of this high ground is now broken at Pitsea, the present shape of the surface there, and the fact that the Thames has there swept away all its own older deposits, and with them probably much of the higher ground, leaving in their place only comparatively modern alluvium, point to the conclusion that the high ground of Laindon Hill was continuous with that of Hadleigh and Rayleigh down to a geologically recent period.

The belt of lowland does not now show a uniform slope from Warley and Laindon to the Blackwater; but that is, as we shall see, the result of denudation, which, at a period much later than that of the superseding of the Romford river by the Thames, has given rise to the streams known as the Mardyke and the Crouch. I think there can scarcely be any doubt that a river at one time flowed through the belt of lowland from the neighbourhood of Romford eastward to the Blackwater below Maldon, and that the old silted-up stream-course seen at Romford was probably a portion of it. And that this river ceased to exist when the Thames eroded away the high ground between its own valley and that of the Romford stream, tapped its water supply, and diverted the drainage of the district.[3]

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[3] West of Romford, the ancient representatives of the Roding and the Lea probably united with the Romford stream and had their outfall in the valley of the Blackwater below Maldon before the Thames altered the course of the drainage. But only east of Romford can we get any evidence as to the course of what I have termed the Romford stream West of that town the Thames Valley deposits occupy the ground, and prevent all knowledge of the earlier physiography of the district.

If we consider the evidence as to the date at which the Mardyke began to flow, we find that it must have begun to exist at a very late period in the history of the Thames Valley; for, high above the western flank of the Mardyke Valley, at North and South Ockendon, we have a plateau capped by gravel belonging to the Thames Valley system, which must have been deposited there when there was higher ground eastward, where the Mardyke now flows 60 or 70 feet below. And that stream, in the lower part of its course, cuts through the gravel, not only of the higher, but also of the lower terraces of the Thames Valley system.

And when we turn to the valley of the Crouch we meet with similar evidence pointing to the lateness of its origin. Assuming, with the Geological Surveyors, that the deposits of gravel and loam which are found about Southend, Rochford, and Canewdon, south of the Crouch, and at Burnham, Southminster, and Bradwell, north of it, are all one series, and were formed on the western flank of the ancient valley of the Thames, the following conclusions are suggested: The maps show that these beds are deposited only on the eastern flank of the high ground of what may be called the Laindon, Rayleigh, and Althorne range, the Crouch Valley being almost wholly destitute of river deposits, with the exception of modern alluvium (just as is that of the Mardyke), though the gravels, etc., of the Thames Valley system are cut through in the lower part of the Crouch Valley as they are in that of the Mardyke. This tends to show that when the gravels, etc., of the Thames Valley system were deposited hereabouts the high ground westward was unbroken by the present outfall of the Crouch. While the existing state of things would naturally arise if the Crouch began to flow only after the destruction, in the fashion shown at Romford, of an earlier stream which flowed through the lowland tract between Cold Norton and Althorne into the Blackwater below Maldon. For the existence of the Crouch would then date from a time when this earlier stream had eroded away everything in its valley above the London Clay, and after the deposition of the Thames Valley gravel and loam between Southend and Bradwell.

The water-parting now existing between the basin of the Crouch and that of the Blackwater is extremely low and narrow between Cold Norton on the west and St. Michael's Church, west of Althorne, on the east. Between Norton Hall and St. Michael's Church, a distance of about two miles, the highest ground now separating the basins of the Crouch and the Blackwater is a belt of land, averaging little more than half-a-mile in breadth, and mainly between 50 and 100 feet above the sea, only a few acres slightly exceeding 100 feet. At St. Michael's Church the surface is 170 feet above the sea, and there is a large area of equal or greater height about Cold Norton. And on looking northward of this water-parting where it is at its narrowest, we see that close to it, at Latchingdon, rises the chief tributary of the Blackwater on its southern side, which is known as Lawling Creek near its outfall south of Osea Island. The low ground between Cold Norton and St. Michael's Church, and the course of Lawling Creek, doubtless mark the route of the ancient stream which flowed north or north-west of Laindon Hill, Rayleigh, and Althorne, before it was superseded by the Thames.

When we remember that at a very recent time, geologically speaking, England must have been united to the Continent, and that still more recently our rivers must have flowed through land close to our shores which is now sea, it becomes evident that we may gain many useful hints as to the ancient physical geography of this district from charts showing the channels and shoals of the adjacent sea. For, though the position of channels and sandbanks is sure to become more or less modified in time through the destruction of land by the sea and other causes, yet there is likely to be a broad general persistence in their arrangement. A chart of the estuary of the Thames shows us what has been done by the planing-down action of the sea on the soft clay, etc., of North Kent and Southern Essex, in forming the broad flat known as the Maplin Sand, and in the still broader submerged flat north of Sheppey and Herne Bay. One thing is specially prominent, and that is the way in which the present channels from the Nore Light eastward all range in a south-westerly and north-easterly direction; so that it would evidently be—in the absence of lighthouses or lightships—a much simpler business to guide a ship along one of these channels towards Amsterdam or Denmark than to take it safely round the North Foreland to Dover or Boulogne. For the course of the south-going ship must be taken through irregular breaches in long and once probably continuous belts of shoal and sandbank. And I think there can be little doubt that the marine channels of the present estuary of the Thames mark, in the main, the former course of the channels of that river and of the Medway when they flowed through then-existing land many miles north-eastward of the Nore Light; while the ground between the ancient channels, planed down by the sea like the land north of Herne Bay and Sheppey, exists as the shoals and sandbanks of to-day.

Though the chart affords no actual glimpse of the state of things when the gravels and loams between Southend and Bradwell were deposited, it evidently adds to the strength of the presumption that they belong to the valley of the ancient Thames. We may also infer from inspection of it that since the period at which the Essex shore-line extended as far eastward as the present coast of the Isle of Thanet, the Thames, below its junction with the Medway, has always taken a north-easterly course. And the influence of the Medway in producing the present aspect of the chart must not be forgotten. When the ancient Romford stream flowed in the valley between Warley, Billericay, and Maldon on the one side, and Laindon, Rayleigh, and Althorne on the other, into the valley of the Blackwater, and the Thames Valley was where the gravels and loams between Southend and Bradwell now lie, the Medway, in all probability, maintained a separate existence for a good many miles out to what is now sea. Among the channels shown on the chart the most northerly, which appears between the sands known as Buxey and Gunfleet, and the Essex shore at and between Clacton-on-Sea and Walton-on-the-Naze, probably gives us a fair approximation to the position of the lower Thames Valley when the gravels between Southend and Bradwell were being deposited higher up. But the Medway at the same period probably took its course along the channel, some miles eastward, called the Oaze Deep and the Black Deep, and joined the Thames some distance to the east of what is now the port of Harwich. It would seem, therefore, that the marine denudation, which has given the estuary of the Thames its present coastline, has reduced the length of the course of the Medway to a much greater degree than that of the Thames.

The evidence afforded by the chart of the channels of the estuary coincides with that to be derived from a geological map showing the shores of both Kent and Essex. From the chart we gather that at a time geologically recent the land due east of what is now Essex extended to a more easterly point than the North Foreland on the Kentish shore, and has since been planed down with special rapidity by marine denudation. And a glance at a geological map shows that here, as elsewhere, the harder rocks have resisted the action of the sea with very much greater suc than the softer. Consequently the Chalk promontories of North and South Foreland have sustained but little loss comp with that of the soft clays and sands to the east and north—n ward of Herne Bay and Sheppey and eastward of the present E shore.

REMARKS ON THE MAP ACCOMPANYING THE PAPER.

This map, in illustrating the present physical geography of S Essex, also shows how many indications still remain of the fo existence of a continuous river valley between N. Ocken Laindon Hills, Rayleigh, and Althorne on the south and east, Warley, Billericay, Woodham Ferris, and Maldon on the north west. These indications become the more significant when remember the evidence, given in the paper, that since the an Thames invaded the valley of the Romford stream and altered course of the drainage, the valleys of the Mardyke and the Cr were formed. And about the same time, the continuity of the ground between Laindon Hills and Rayleigh was destroyed thr the northerly turn once taken by the Thames towards Pitsea. ground west and south-west of Romford, less than 100 feet a the sea, being occupied by Thames river-deposits, necessarily aff no evidence of anything but the former presence of the Tha there.

THE ESSEX FIELD CLUB.

SATURDAY, FEBRUARY 8TH, 1896.

THE 160th ORDINARY MEETING of the Club was held in the rooms of Young Men's Christian Association, Stratford, at 7 o'clock, Mr. D. How President, in the chair.

The following were elected members: Miss Lee-Warner, Mr. Ferdinand Col Mr. John Young, F.L.S., F.Z.S., Mr. J. C. Stogdon, and Mr. W. Vincent.

Mr. W. Cole exhibited specimens of the "Cores" obtained during the expe mental Boring in search of Coal at Stutton, in Suffolk, which had been present to the Museum by Mr. Graham. Three sets of these lowermost Cores had be preserved, and the other two specimens had been deposited in the Ipswich Museu and in the Museum of the University of Cambridge respectively.

Mr. T. V. Holmes made some observations on these specimens, and on th borings generally (see further reports on the Stutton Boring in the presen volume).

Mr. Cole also exhibited a specimen of the Large Green Grasshopper (*Locust veridissima*) from the coast at East Mersea, together with two other species o Locusdidæ (the apterous species, *Thamnotrizon*, L., and *Platycleis grisea*, Fab.

with the pretty green tree locust, *Meconema varium*, Fab., which is often seen on "sugar" in Epping Forest) from the same locality. Mr. Cole said that he had recently been collecting Orthoptera in Essex, and he thought that the number of species occurring in the county would compare favourably with other parts of England. He recommended the study of the group to the attention of those in search of a subject for field work, less hackneyed than the butterflies or the beetles.

Mr. T. V. Holmes exhibited and presented to the Club a copy of the new Index Map (No. 12 of the Geological Survey) of the geology of the London Basin, and made some remarks upon the Map, as did also the President and Prof. Meldola (see Mr. Holmes' notes on this Map, *ante*, pp. 112-115).

Votes of thanks were passed to Mr. Graham for his donation of the Cores, and to Mr. Holmes.

Mr. T. V. Holmes, F.G.S., read a paper entitled, "Notes on the Ancient Physiography of South Essex," illustrating his remarks with specially coloured 1 in. Ordnance Maps of the district (this paper is printed in the present volume, the Map being reproduced by the Collotype process).

The President, Prof. Meldola, Mr. Elliot, and Mr. Crouch, spoke on the subject, and Mr. Holmes was cordially thanked for his paper.

Mr. Robert Paulson then gave a Botanical Address, of which the following is an abstract, his remarks being amply illustrated by diagrams and specimens:

ABSTRACT OF MR. PAULSON'S ADDRESS ON THE FLOWERS AND FRUIT OF THE UMBELLIFERÆ.

Systematic botany is often regarded in the educational world as being far inferior to that of the other branches of the science, viz., anatomy and physiology. The latter are said to require the exercise of the higher qualities of the mind for their pursuit.

Much may be said in favour of the above view, if the Systematist remains as such, and develops into a mere collector of plants, knowing many of them, or fancying he knows them, because some one has told him their names.

In the presence of members of a Field Club it is not necessary to urge the importance of *field work*, or to attempt to prove that such work after business hours adds considerably to the pleasures of life.

Those whose aim is to do or discover something that has not been done or discovered before, who say that there is no scope in systematic Botany, no doubt bring some discredit on the subject.

It may be true that there is little chance of discovering anything new, but the amateur on taking up this, as well as other subjects, soon becomes aware that he cannot begin exactly where others have left off, and that it takes some time to acquire present-day knowledge, the acquisition of which may be pleasurable or otherwise, according to the methods adopted.

The present methods of teaching Botany, and this, of course, is a response to the requirements of examiners in high places, has caused much of the neglect of the systematic branch. Students can often describe with the minutest detail the development of the archegonia and antheridia of a fern, and yet they are totally unable to recognise the most familiar of the British ferns in the field.

The Natural Order Umbelliferæ has been chosen for this demonstration, because it is decidedly better, after making a little headway, to confine oneself for certain periods to particular groups of plants, the Umbelliferæ not presenting the difficulties of Grasses, Sedges, Roses, Brambles, and Willows, yet require a fair amount of attention if we would know them well.

Then followed :

Description of a typical plant.
Distribution of Umbellifers.
Number of British Genera and Species.
The minute structure and development of flower.
Insect visitors, pollination.
The fruit, minute structure of, as an aid to classification.
Seed distribution.

The whole illustrated by Herbarium specimens and micro-preparations of fruits.

Mr. Paulson concluded with a few remarks upon some of the more interesting Essex species of the Order. As regards Essex Umbellifers one cannot omit to mention the Genus *Bupleurum*. Of the four species of this genus found in Great Britain, three are found among Essex plants. *Bupleurum tenuissimum*, L., is a characteristic plant along many of the sea-walls of the county, notably at Burnham-on-Crouch. Then there is:

B fulcatum, L., found between Ongar and Chelmsford, and *B. rotundifolium*, L , in many cornfields.

Coriandrum occurs occasionally in fields about Burnham-on-Crouch, as well as at its old station.

Torilis infesta, Curtis, is quite a weed in some of the cornfields in the Forest area.

In Gibson's "Flora of Essex," 28 Genera and 47 species of Umbelliferæ are recorded, and we may at least claim for the Forest 27 species actually existing at the present time.

Both Mr. Paulson and the Secretary explained the object of the Demonstration as being the first of a series which the Council had sanctioned, with the object of rendering the Field Meetings more interesting and instructive. It was pointed out that one of the main objects of the Club is the encouragement of what used to be termed "Natural History," and, in fulfilment of that object, an endeavour would be made to provide *practical demonstration in the field* on branches of Natural History and Geology, supplemented by expositions at the meeting-place at the end of the ramble. In some cases the Demonstrations on any particular subject would extend over two or more meetings.

Members were particularly requested to observe that these proposed demonstrations would not interfere with the ordinary features of the Field Meetings, but would be in addition thereto. They will, it was hoped, afford that practical information and hints for field-work which so many members have desired to receive. It was anticipated that some members would thus be encouraged to collect for the Club's Museums ; *but a serious word of caution must be given*—"do *not* collect unless you have a real object in so doing."

Mr. Cole, in making these announcements on behalf of the Council, trusted that in thus endeavouring to meet a general desire they would be encouraged, by full attendances at the meetings, to persevere in a course which in some cases might involve considerable trouble and expense.

Prof. Meldola and the President spoke of the interest and practical value of such demonstrations as that given by Mr. Paulson, and a cordial vote of thanks was passed to him.

The meeting closed with the usual service of tea and coffee.

It was announced that at the first meeting of the season, Mr. E. M. Holmes, F.L.S., would conduct, and give a practical demonstration on the MOSSES of Epping Forest.

FIRST FIELD DEMONSTRATION MEETING AND 161ST ORDINARY MEETING FOR NOMINATION OF NEW MEMBERS OF COUNCIL AND OFFICERS FOR 1896-97.

Saturday, March 14th, 1896.

Conductors—E. M. HOLMES, Esq., F.L.S. (*Curator of the Museum of the Pharmaceutical Society*), and E. D. MARQUAND, Esq.

THIS was the first meeting under the arrangement proposed by the Council for the encouragement of the practical study of Botany and other branches of natural science in the field. Mr. E. M. Holmes very kindly undertook the conductorship of the inaugural meeting, choosing the *Mosses* and *Scale-Mosses* (Muscineæ) as the objects to be searched for, these plants being in the best condition about this time of the year. Mr. E. D. Marquand, a naturalist well known for his researches into the fauna and flora of Jersey and the Isle of Wight (and compiler of the List of the Cryptogamic Flora of Kelvedon, from materials left by the late Mr. E. G. Varenne in ESSEX NATURALIST, vol. v. pp. 1-30), gave us the benefit of his presence and assistance.

Monks Woods and the lower ground at Debden Slade, Epping Forest, were the localities chosen for the day's huntings. The Conductors and the Secretaries were early on the ground, the other parties coming down by later trains to Loughton, and so over Staples Hill and Cowper's Camp into Monks Woods. A large number of species of Mosses were collected, and the Conductors were busy the whole afternoon in demonstrating the various points of interest and distinction of the several species and genera.

Mr. Holmes was happy in re-discovering the rare moss, *Zygodon forsteri* in the habitat originally noted by him in September, 1882 (see short paper by Mr. E. M. Holmes on "*Zygodon forsteri*, Mitten, in Essex," in "Proceedings Essex Field Club," vol. iii., pp. lxii., lxiii.). The plant was first discovered by Mr. T. F. Forster on a felled tree in a timber yard at Walthamstow, probably brought from Epping Forest. It remained almost unique until a station was found at Minehead in Somerset, by Miss Gifford, and later the Epping Forest locality was recorded by Mr. Holmes as above. It is very remarkable that such a rare plant should have been preserved so many years in what was probably the station whence came the original specimen found by Forster.

The afternoon was showery, but collecting was persevered in until a little after five, when an adjournment was made to the "Wake Arms" for tea.

After tea, the 161st ORDINARY MEETING was held, the President in the chair.

It was announced, on the circular calling the meeting, that the Annual

Meeting would be held at the end of March, and in anticipation of it, the Council's nominations of new members of Council and officers for 1896 were made. (See Report of Annual Meeting, page 205.)

No other nominations were made, nor had the Secretary received any.

The President then called upon Mr. Holmes to give his Demonstration on the Mosses.

Mr. Holmes had brought a large collection of type specimens of Mosses, with microscopical preparations, fresh specimens of Mosses from the Sevenoaks district, comprising examples of all the groups, and a large number of beautifully clear diagrams which had been arranged around the walls of the meeting-room.

He gave an excellent demonstration, alluding among other points to the following: "Differences between Club-Mosses, Scale-Mosses, and true Mosses—Modes of classifying Mosses (1) by the leaf structure, (2), by the character of the fructification—Modes of reproduction—How to collect Mosses—How to examine them, and how to preserve them—The species to be looked for in the Forest—Books recommended as aids to the study of Mosses."

Mr. Marquand supplemented Mr. Holmes' lecture by some practical remarks and suggestions for beginners.

Mr. T. V. Holmes, V.P. (who was in the chair, the President having to leave before the end of the meeting), proposed that a hearty vote of thanks should be accorded to Mr. Holmes and Mr. Marquand for their valuable services, and the vote was passed by acclamation.

The remainder of the evening was spent in examining the numerous specimens and engravings of Mosses on the table, and then the members drove or walked to Loughton, or Chingford, *en route* for home.

THE 16TH ANNUAL GENERAL MEETING.

Saturday, March 28th, 1896.

THE 16th ANNUAL GENERAL MEETING of the Club was held in the small lecture room of the Young Men's Christian Association, West Ham Lane, Stratford, at 7 o'clock, Mr. D. Howard, President, in the chair.

The minutes of the 15th Annual Meeting, held on March 30th, 1895, were read and confirmed.

The Report of the Council for the year 1895 was read and adopted (see p. 141).

The Treasurer's Statement of Account was read by Mr. W. C. Waller, although the Audit Meeting had not taken place, owing to engagements of the Auditors. The Statement was received and adopted, and was subsequently signed by the Auditors and presented to the Council on June 16th (see p. 143).

The Hon. Curator read his Interim Report on the Central Museum (see p. 145) and his Report on the progress of the Epping Forest Museum (see p. 146). Both these reports were received and adopted.

No report on the condition of the Library was presented, but in answer to a question Mr. Durrant said that he was preparing a list of Periodicals and Transactions received at the library for the use of Members.

At the meeting on March 14th last the following members of the Council retired under Rule IV., but, with one exception, offered themselves for re-election: Messrs. B. Corcoran, G. Day, A. J. Furbank, and J. H. Porter.

At the meeting on March 14th the following members were duly proposed and seconded for ELECTION into the COUNCIL: Messrs. B. Corcoran, A. J. Furbank, J. H. Porter, A. Lockyer (on retiring from the Treasurership), and G. E. Vaughan.

As OFFICERS for the year 1896, the following were nominated: *President*, Mr. David Howard, J.P., F.C.S.; *Treasurer*, Mr. W. C. Waller, M.A., F.S.A.; *Hon. Secretaries*, Mr. W. Cole, F.L.S., and Mr. B. G. Cole; *Librarians*, Mr. E. Durrant and Mr. W. C. Waller; *Hon. Counsel*, Mr. W. C. Dare, B.A., Barrister-at-Law; *Hon. Solicitor*, Mr. H. I. Coburn.

As *Auditor (for Council)*, Mr. Walter Crouch, F.Z.S.; (*For Members*), Mr. J. D. Cooper.

No other members having been proposed, the above gentlemen stood elected by Rule VII. as members of the Council and Officers for the year 1896, and were so declared by the Chairman.

[The following therefore constitute the Officers and Council for 1896:—

PATRON.—H.R.H. the Duke of Connaught and Strathearn, K.G.

PRESIDENT.—David Howard, J.P., F.C.S.

PERMANENT VICE-PRESIDENTS—(*Under Rule IV.*).—Prof. R. Meldola, F.R.S., F.R.A.S., Pres. E.S., &c. (*President* 1880-82); Prof. G. S. Boulger, F.L.S., F.G.S. (*President* 1883-84); T. V. Holmes, F.G.S., M.A.I. (*President* 1885-87); E. A. Fitch, F.L.S., F.E.S. (*President* 1888-91); Dr. Henry Laver, F.L.S, F.S.A. (*President* 1892); Frederic Chancellor, J.P., F.R.I.B.A. (*President* 1893-94).

OTHER MEMBERS OF COUNCIL—John Avery, C.A.; Rev. R. E. Bartlett, M.A.; C. E. Benham; Horace T. Brown, F.R S; E. N. Buxton, J.P., Aldmn. C.C., D.L., &c.; Miller Christy, F.L.S.; Walter Crouch, F.Z.S.; Bryan Corcoran; L. Cranmer-Byng; F. W. Elliott; A. J. Furbank; I. Chalkley Gould; Rev. W. C. Howell, M.A.; Andrew Johnston, Chm. C.C., J.P., &c.; Rev. W. S. Lach-Szyrma, M.A.; Alfred Lockyer; J. H. Porter; Right Hon. Lord Rayleigh, F.R.S.; J. C. Shenstone, F.R M.S.; John Spiller, F.I.C., F.C.S.; J. C. Thresh, D.Sc., M.B.; F. H. Varley, F.R.A.S.; George E. Vaughan; T. Hay-Wilson.

HON. TREASURER.—W. C. Waller, M.A., F.S.A.

HON. SECRETARY AND DIRECTOR.—William Cole, F.L.S., F.E.S.; ASSISTANT HON. SECRETARY.—B. G. Cole.

HON. LIBRARIANS.—Edmund Durrant and W. C. Waller.

HON. COUNSEL.—W. C. Dare, B.A., Barrister-at-Law; HON. SOLICITOR.—H. I. Coburn.]

Mr. Howard then delivered his Annual Presidential Address, which mainly dealt with the question of Water Supply in the Lea Valley (*see* p. 149).

Professor R. Meldola, in proposing a vote of thanks to the President for his address and for his services to the Club during the year, said he had handled his subject in a most admirably lucid manner. The address was a good general sketch of the water question in its chemical, biological, and economic aspects.

Mr. F. H. Varley seconded the proposal, and said he wished to lay the bogie that the water from Wales was so pure that it would corrode the pipes, and cause people to die from lead poisoning. The motion was carried unanimously.

Mr. Howard briefly replied.

Mr. Thos. Thompson asked if there was any necessity for the use of lead pipes in the supply of water? The remedy was a simple one, and it was to substitute iron pipes for lead ones. The supply of water from Thirlmere to Manchester passed through a culvert in which neither lead nor iron was used, and he did not see why all service pipes should not be made of iron.

The Chairman said there was no doubt iron was the best, if you could persuade the workmen to use it.

Both in the Presidential Address and in the Report of the Council, cordial acknowledgment was made of Mr. Lockyer's long and arduous work on behalf of the Club, as Librarian and Treasurer, and at the meeting great regret at his retirement from office was expressed.

A vote of thanks to the Officers of the Club concluded the business of the meeting, which then resolved itself into a conversazione, at which light refreshments were served as usual.

FOREST AND FIELD RAMBLE, AND SECOND BOTANICAL DEMONSTRATION.

Saturday, May 2nd, 1896.

FOR the purpose of affording scope for Mr. Paulson's Field Demonstrations, it was decided to repeat the ramble through that part of the Forest to the Sewardstone Lanes taken in 1893 (see ESSEX NATURALIST, vol. vii., pp. 95-99), the spring woodlands and rich valley slopes affording an ample flora, not to speak of the interesting waterside plants of the alluvial banks of the old River Lea. Some interesting topographical and antiquarian details of the district traversed will be found in the Report of the previous Excursion alluded to above.

The members and friends met at about 3.30, at the corner of Bury Wood, near the "Woodman," and Mr. Paulson having assumed the rôle of "Botanical Conductor," the work of the afternoon began in gathering some of the most common of our spring flowers, and noting points that are often overlooked by those who neglect the most abundant species. In Bury Wood a halt was called that we might examine one of the Wood-Violets, *Viola riviniana*, Reich., and observe how it differed from the other woodland form, *Viola silvestris*, Reich. Later in the afternoon we were able thus to compare *Cardamine hirsuta*, Linn, and *Cardamine flexuosa*, With., two plants often passed as one by those whose object is to seek for rarities only.

A very interesting floral sight was afforded by the abundance of the white flowers of the Wild Garlic, or "Ramsons" (*Allium ursinum*, L.), which is more common in this wood than in any other part of the Forest.

The party then returned to the corner of the wood, and passing over the long green leading to Sewardstone Common, made their way down Gillwell Lane, a most pleasant way, the ditches and banks gay with hedgerow flowers, over which an abundance of early insects hovered. We noticed nothing very rare or remarkable, but the countless blossoms and bright active insects gave a full sense of a beautiful and bountiful spring. Mr. Paulson took great pains to point out the distinguishing characteristics of the numerous plants observed.

From the meadows at the end of the lane, which sweep down to the river, a charming view was obtained of part of the Lea Valley, the breadth and beauty of the scene quite astonishing those new to the district.

The party then made their way down the slopes to the Sewardstone Lane and so to the banks of the old River Lea, Izaak Walton's river Lea, at the Sewardstone Mill, where most of the common spring riverside plants were noticed and commented upon.

Tea was taken at a small road-side inn, the "Royal Oak," after which Mr. Paulson gave a short address on the "Use and Abuse of a Flora," the chair being occupied by the President, Mr. David Howard.

It was shown that a "Flora" can be used with advantage even on those plants which we see every day, that the mere knowledge of the name is a very secondary matter, and that it is not until we know something of its habits, its adaptations for cross or self fertilisation, its means of defence against unbidden guests, the method of the dispersion of its seeds, etc., that we can be said to know a plant. Mr. Paulson also treated briefly of the following subjects:

(1) Notes on the Classification of Flowering Plants into Class, Sub-class, Division, and Order.

(2) Difficulties met with in the above classification.

(3) Frequent errors in the use of a Flora.

(4) Incomplete Floras to be avoided. Why?

(5) Imperfections of a Flora. Two to be consulted when possible.

The specimens gathered during the afternoon were used to illustrate the points brought forward.

During the meeting the Secretary exhibited the following specimens on behalf of Mr. Wilfred Mark Webb, F.L.S.:

(1) A series of the shells of all the British species of *Testacella*, among which were Essex examples of *Testacella scutulum*, already recorded [ESSEX NATURALIST, vol. vii. (1893), p. 46, Figured p. 121] from Buckhurst Hill, and of *T. haliotidea*, which is new to the county, from Widford and Stisted [see "Journal of the Essex Technical Laboratories," vol. ii., pp. 127 and 242], and

(2) Two living *Helix pomatia* obtained near Chappel in the Colne Valley, which are the first authentically recorded ["Journ. Essex Tech. Labs.," vol. ii, p. 241, Fig. 107] specimens from Essex, though several isolated examples have been met with in the county.

The return journey was a pleasant route by the footpath opposite the inn, over the "hanging" meadows, in which cowslips were abundant, through a little wood, almost completely filled with the curious Dogs' Mercury (*Mercurialis perennis*), and so by the old forest way, the Bury Path, to Chingford Station.

FOREST RAMBLE AND THIRD BOTANICAL DEMONSTRATION.

Saturday, June 20th, 1896.

THE third Botanical Demonstration took place on the above afternoon, and was combined with a Forest ramble in the beautiful woods near Theydon Bois, in Epping Thicks, by Ambresbury Banks, etc. To afford more time for the researches of the botanists, tea was served in the woods in a tent erected in Epping Thicks, by kind permission of the Superintendent of the Forest.

The main body of members assembled at Theydon Bois Station at a little after three o'clock, others walking over the Forest, and joining in at Piercing Hill. The weather was delightful, and very many objects of natural history were observed.

Mr. Paulson was Botanical Cönductor, and the work sketched out for the meeting consisted mainly in the collecting and examination of the Grasses and Sedges of the Forest, especially heath, bog and woodland forms.

The early part of the afternoon was spent on the slopes of Piercing Hill, in Epping Thicks, and in the beautiful forest glades near Ambresbury Banks.

The following species of CARICES were collected mainly in this locality, but a few were noticed in traversing the part of the Forest known as "St. Thomas's Quarters" in the evening: *Carex echinata*, Murr.; *C. remota*, L.; *C. ovalis*, Good.; *C. goodenowii*, J. Gay; *C. flacca*, Schreb.; *C. verna*, Chaix.; *C. panicea*, L.; *C. sylvatica*, Huds.; *C. lepidocarpa*, Tausch.; and *C. hirta*, Linn.

[The botanist is referred to Mr. Paulson's paper "Notes on the Carices of the Epping Forest Area" in ESSEX NATURALIST, vol. iv. (1890), pp. 135-137, for full list of species now known to grow there.]

Among the other plants noticed may be mentioned *Anagallis tenella*, L.; *Wahlenbergia hederacea*, Reichb.; and the grasses *Deschampia flexuosa*, Trin., and *Sieglingia decumbens*, Bernh.

Tea was taken in a tent, erected by Messrs. Riggs and Sons, in a pleasant glade just outside the ramparts of Ambresbury Camp. Afterwards Prof. Meldola took the chair, and Mr. Paulson gave a short demonstration upon the plants gathered during the ramble, and including a comparison of the leaves, stems, and flowers of a *Carex* and a Grass, illustrated by the plants in hand.

Then the way home to Loughton was taken by a circuitous route, through St. Thomas's Quarters, by the Wake Valley Ponds, through Monks Wood and Loughton Camp, down to Debden Slade, many interesting plants being observed and commented on as opportunity offered, and so to Loughton Station.

It was a subject of frequent remark, and was exceedingly disappointing to the naturalist to witness, the slow extinction of the bog flora of the Forest, caused by the straight ditches cut through the bog land. These ditches are not confined to the more frequented parts, but they intersect some of the most secluded spots where the flora might be allowed to remain in all its original luxuriance without inconvenience to any one.

SECOND VOYAGE DOWN THE LEA FROM HERTFORD TO WALTHAM ABBEY.

Saturday, June 27th, 1896.

"'That is the good fortune of most of our home Counties,' said Mr. Braefield; 'they escape the smoke and din of manufacturing towns, and agricultural science has not demolished their leafy hedgerows. The walks through our green lanes are as much bordered with Convolvulus and Honeysuckle as they were when Izaak Walton sauntered through them to angle in that stream!'" LYTTON'S "Kenelm Chillingly."

Conductors—Major LAMOROCK FLOWER, F.San.I. (*Sanitary Engineer to the Lee Conservancy Board*), J. C. SHENSTONE, Esq., WILFRED MARK WEBB, Esq., F.L.S., ROBERT PAULSON, Esq., and the *Hon. Secretaries*.

MAJOR LAMOROCK FLOWER having again promised his valuable aid as "Conductor," and, by the courtesy of the Lee Conservancy Board, the steam barge *Salisbury* having been for the third time placed at the disposal of the Council, it was determined to repeat the voyage from Hertford downwards, which was so much appreciated by the members on July 14th, 1894. It was felt that those joining the party would have ample opportunities of becoming acquainted with the quiet pastoral beauties of Izaak Walton's river, and of seeing the rich field the district affords for the researches of out-door naturalists.

The party embarked on board the *Salisbury* from the towing path, near the road from the railway station, some having travelled down by the 9.30 train from London, while others had taken advantage of the drag conveying the materials for tea and the Secretaries' books and specimens from Buckhurst Hill and Loughton. The barge had been admirably fitted up, and the cabin afforded table space for the exhibition of Mr. Webb's fine collection of the British Land and Fresh-water Shells, which was much admired and studied during the day.

H. A. Cole. 1896.

THE RIVER BANKS NEAR HARD-MEAD LOCK, WITH WARE IN THE DISTANCE.

[*Drawn June 6th, 1896, by H. A. Cole.*]

A general account of the River Lea, as an important source of the water supply of London, with many antiquarian details, was given in the report of the first voyage from Hertford on July 14th, 1894 (see ESSEX NATURALIST, vol. viii, pp. 205-213), and in the account of the voyage from Broxbourne to Waltham Abbey, undertaken last year (E. N. present volume, *ante*, pp. 57-[illegible]), so that little need be said on the present occasion. Copies of Major Flower's brochure "The River Lee up to Date," containing much information respecting the river, were again kindly presented to the voyagers by our genial Commander, and numerous books, plans, and maps were placed on the tables during the day for general information.

At the present meeting it was desired that more particular attention should be paid to the rich flora of the Lea Valley, and the many interesting invertebrata to be found in the waters and on the banks of the streams.

Botanising began as soon as we were on the *Salisbury*, and Mr. Paulson and Mr. Shenstone were soon busily employed in identifying plants. The bed of the river just below Hertford is crowded with *Potamogetons*, so that a few minutes with the drag brought *Potamogeton perfoliatus*, L., *P. lucens*, L., and *P. pectinatus*, L., on deck for our examination. *P. densus*, L., was not taken till much later in the day. It is abundant in the shallow water about the Rye House.

A short time after starting we came to an immense rubbish heap on the left bank of the river, which was covered with vegetation. Not being able to resist such a temptation, the captain was requested to call a halt, so that the whole party might land. It proved a happy hunting-ground. *Hyoscyamus niger*, L., was in full blossom and growing most luxuriantly, some of the plants being from three to four feet in height. Among many plants taken at this spot were *Lepidium ruderale*, L., *Camelina sativa*, L., and the grasses, *Phalaris canariensis*, L. (an evident alien), and *Apera Spica-venti*, Beauv., with very many common but interesting plants.

On the flowers and seed-pods of the Water Figwort (*Scrophularia aquatica*), which was growing luxuriantly on the banks, were a number of the handsome caterpillars of the "Shark" moth (*Cucullia verbasci*), feeding quite exposed on the topmost stems, and which afforded occasion for a little talk on the utility of "warning-colours" in protecting such larvæ from attack. They are probably unpleasant to the taste, and birds are "warned" by the bright colours and the conspicuous, almost defiant, positions assumed by the caterpillars, not to meddle with such unsavoury morsels.

Some of the plants were also covered with the curious "slimy" larvæ of the pretty Weevel *Cionus scrophulariæ*, Linn., a beetle, which is itself so admirably protected by its likeness to a small lump of dry earth, when it folds its legs round its body and drops off the plant at the least alarm.

Here the shell, *Succinea elegans*, was found, among others, on the rushes bordering the stream, and the larvæ of the butterflies, *Vanessa urticæ*, *V. io*, and *V. atalanta* were noticed on the nettles.

Re-embarking we were soon among the sedges, at a spot the poet might have had in mind when he wrote of "The gulfy Lea with sedgy tresses." We noted in a short time, *Carex riparia*, Curtis, *C paludosa*, Good, *Carex paniculata*, L., and *C. hirta*, L. These formed a valuable addition to our list of the previous Saturday afternoon in Epping Forest. On that occasion we went out purposely for sedges, but those collected were chiefly woodland forms.

To quote from the excellent paper "On the River Lea below Hertford," by our member, Lieutenant R. B. Croft, F.L.S., in the "Transactions of the Hertfordshire Natural History Society" (vol. ii., pp. 244, 245), the Lea, after passing by the Bury Field, supposed to have been the burial ground of the monks of Ware Priory, "flows through the pleasant busy town of Ware. The staple trade here is malt-making, and the many cowls form a curious and picturesque feature in the landscape; many barges trade from this place, conveying malt, bricks, and gravel to London, and returning laden with barley, coal, or other merchandise. Before the New River was formed, the water from the Chadwell Spring used to flow into the Lea near where the bridge is now built. Below the town is the navigation cut, which rejoins the old bed of the stream near St. Margarets. The portion of the river thus cut off is very beautiful as it winds its sinuous way, fringed with pollard willows, through the rich meadows. These are the waters which old Izaak Walton loved so well and described so happily in his perfect pastoral 'The Complete Angler'; here he assisted at the destruction of that 'villainous vermin,' the otter; and here he caught that wonderful chub—that chub with the white spot on his tail, that we all wot of so well. These waters

AMWELL CHURCH, FROM THE LEA. [*Drawn June 6th, 1896.*]

are still famed for their fish, they are strictly preserved, and with others in the neighbourhood are known as the Amwell Magna Fishery."

Mr. Webb gave a brief discourse on deck on the records for Essex Mollusca which he had registered for his paper, "read" later in the day, and illustrated his remarks by reference to his own collection which was displayed in the cabin.

Soon after Amwell Church was seen nestling among the trees on the high ground on the right, a picture of which Mr. H. A. Cole had drawn for the circular. "Here," again to quote Mr. Croft, "is a copious spring (Emma's Well), the waters of which reinforce the New River, and here are the remains of very considerable earthworks, surmised to be those made by King Alfred during his campaign against the Danes. Nearly opposite, on the left bank of the river, is a field called 'Garrison Field,' where a quarter of a century ago a rampart could be traced; this is supposed to be the site of Alfred's second fort. A barrow has recently been discovered at Easneye, which occupies a wooded prominence opposite Amwell, but it has not as yet been explored."[1]

The second halt was made at the Rye House, where luncheon was served.

Afterwards an ORDINARY MEETING of the Club (the 162nd) was held, Mr. J. C. Shenstone, Vice-President, in the chair.

The following were elected members: Mr. F. G. Adair Roberts, Mr. James Vining, and Mr. H. Wood.

Mr. Shenstone proposed a hearty vote of thanks to Major Flower for his services, given for the third time, in arranging these pleasant meetings on the Lea, and to the Lee Conservancy for their kindness in again lending the *Salisbury* for the excursion.

Major Flower replied, and said that it had afforded him much pleasure to be of any service to the Club.

Mr. W. M. Webb, F.L.S., read the title, and gave a few words in explanation, of Part I. of "The Non-marine Mollusca of Essex," being a systematic catalogue of all the species of land and fresh-water Mollusca hitherto found in our county. [This paper will appear in THE ESSEX NATURALIST.]

On behalf of Mr. W. Whitaker, F.R.S., Mr. Cole "read" the title, and gave a few words of explanation, of a paper on "Some Essex Well-Sections, Part IV., with some Water Analyses" [see *ante*, pp. 167-190].

Mr. W. C. Waller, F.S.A., was announced to read the "Report on the Barclay-Johnston MSS. and Papers in the Epping Forest Museum Library" [*ante*, pp. 157-160], but as he considered the paper too technical, it was taken as "read," and Mr. Waller substituted a short paper entitled "An Episode in the History of the River Lea" [*ante*, pp. 190-193].

A saunter along the banks of the river at Rye House after lunch brought to light many smaller plants which could not be seen or reached from the barge. It was here that we saw the wasps visiting the flowers of *Scrophularia aquatica*, L., and were able to examine the adaptations for cross fertilisation in this plant, as well as in that of *Mimulus luteus*, L., with its irritable stigma.

Many of the visitors were interested in examining the remains of the Tudor building The Rye House, the scene of the celebrated plot having for its object the assassination of Charles II. and his brother, the Duke of York, on their return from Newmarket. The Gate House is the only part of the old building that remains, but new buildings have been erected, occupying to a great extent the sites of the old ones, so that the general appearance now is much the same as is shown in the plan printed in 1685, in the "True account and declaration of the horrid conspiracy against the late King, his present Majesty and the Government, as it was ordered to be published by his late Majesty." A room in the Rye House is the present resting-place of the "Great Bed of Ware," mentioned in Shakespeare's "Twelfth Night":

> "*Sir Andrew Ague-cheek.* Will either of you bear me a challenge to him?
>
> "*Sir Toby Belch.* Go, write it in a martial hand; be curst and brief: it is no matter how witty, so it be eloquent, and full of invention: taunt him with the licence of ink: if thou 'thou'st' him some thrice, it shall not be amiss; and as many lies as will lie in thy sheet of paper, although the sheet were big enough for the Bed of Ware in England, set 'em down."

---

[1] We give the above statements on Lieut. Croft's authority, although but little reliance can be placed on local traditions connecting these works with Alfred, in the absence of systematic exploration of the earthworks.—ED.

On the resumption of the voyage, the first object to attract notice was the growth of *Mimulus luteus*, L., on the banks of the river. The appearance was remarkable; the botanists had been told by the Secretary that the plant was spreading, but they appeared scarcely prepared for the glorious edge of gold given to the river margins for a considerable distance. No one could thoroughly appreciate this except from a barge, or boat, in mid-stream.

During the afternoon occasion was taken by Mr. W. Cole to give a demonstration on some curious points connected with the life-histories of various aquatic insects which occur in the river, his explanations being illustrated by specimens. An account of the aquatic insects noticed on this and other occasions is deferred until another occasion, when the list may be more complete.

Mr. Paulson also gave an exposition of the plants collected.

Tea was served on board, accompanied by a plentiful supply of strawberries, from Mr. J. B. Clark's Fruit Farm at Braughing, Herts.

The last halt, just above Cheshunt, gave an opportunity for searching the meadows and ditches in the neighbourhood for plants and shells.

Amongst many commoner Mollusca, Mr. Webb secured specimens of *Helix arbustorum* and *Vertigo pygmæa*.

A complete list of the plants observed could not be easily made on such an excursion, where the experts were fully employed in naming and answering the questions of inquirers, but those who took an active part in collecting had a most favourable opportunity of seeing the typical plants of a riverside flora in June. The following plants were exhibited on deck during the afternoon, in addition to those mentioned above: *Malva rotundifolia*, L.; *Malva sylvestris*, L.; *Nasturtium amphibium*, R. Br.; *Epilobium parviflorum*, Schreb; *Symphytum officinale*, L.; *Myosotis palustris*, Relh.; *Veronica anagallis-aquatica*, L.; *Scutellaria galericulata*, L.; *Iris pseudacorus*, L.; *Phalaris arundinacea*, L.; *Deschampsia cæspitosa*, Beauv.; *Briza media*, L.; *Glyceria aquatica*, Sm.; *Glyceria fluitans*, R. Br., and *Scirpus lacustris*.

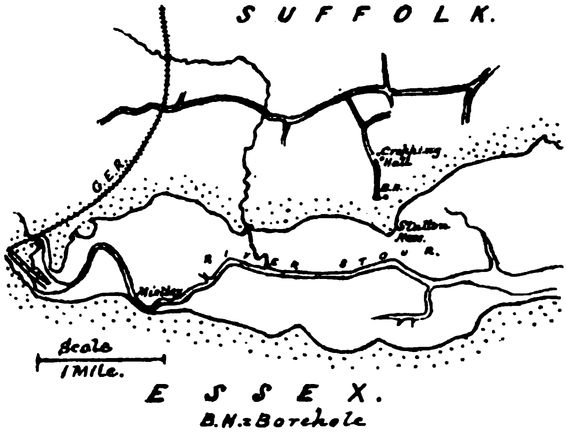
Major Flower was heartily cheered when he left the barge, and acknowledgment was made of the services of the other Conductors, to whose exertions a most pleasant and profitable day was so largely due. The voyage terminated at Waltham, whence, after a visit to the Abbey, some of the members took train to town, and others drove back to Loughton, Chingford, and Buckhurst Hill.

COAL UNDER SOUTH-EASTERN ENGLAND.

BORINGS IN SEARCH OF COAL IN SUFFOLK AND ESSEX.

THE following notes are in continuation of the reports by Mr. T. V. Holmes, F.G.S., and Mr. W. Whitaker, F.R.S., published in THE ESSEX NATURALIST, vol. viii., pp. 142-150, and may be taken as bringing our information on the subject up to the date of publication (October, 1896). Further particulars will be given as the work at Weeley, Essex, proceeds.

Towards the close of last year the directors of the Eastern Counties Coal-boring and Development Association decided to discontinue the boring at Stutton, on the north bank of the Stour. (See ESSEX NATURALIST, viii., p. 143, and sketch map herewith.) The boring was upon the land of Mr. Graham, of Crepping Hall, and that gentleman is deserving of great praise for the enthusiasm he showed in the scheme, and for the personal assistance he gave the directors and the contractors for the boring—the Vivian Boring Company, of Whitehaven. The depth to which the bore was made is 1,525 feet, through the following strata :—



SKETCH-MAP SHOWING THE POSITION OF THE SUFFOLK BORING.

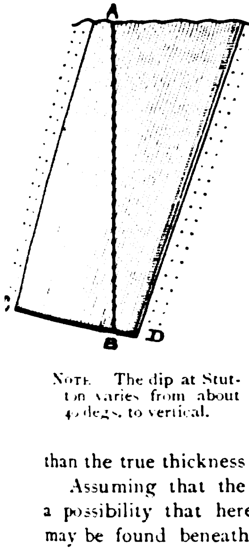
	Feet.
Drift (River Gravel)	16
London Clay and Reading Beds	54
Upper and Middle Chalk	720
Lower Chalk, with very glauconitic marl at the base (almost a Greensand)	154½
Gault	49½
Palæozoic Rock, with a high dip	531
Total	1525

The continued appearance of the same Palæozoic Rock led the Directors of the Association to confer with the Geological experts, Mr. W. Whitaker (who read a paper at the British Association Meeting at Ipswich upon the boring) and Mr. T. V. Holmes, who presented the following valuable report :

THE STUTTON BORING, ETC.

The question now arising with regard to this bore-hole is whether, alike on geological and on economical grounds, it would be better to continue it or to begin another a few miles away.

The leading feature of this first boring of the series is the general similarity of the rocks at Stutton to those of Harwich. The Chalk and Gault are both somewhat thinner at Stutton, the Palæozoic floor being at a depth of 1,029 feet at Harwich and 994 feet at Stutton. And in both cases the uppermost Palæozoic rock was a hard grey or slate-coloured sandy shale. No fossils have been found at Stutton, though markings suggesting their presence have been noticed from time to time. But cores containing the most promising of these having been sent to Jermyn Street Museum, and carefully examined by Mr. W. W. Watts and Mr. E. T. Newton, F.R.S., of the Geological Survey, nothing has been found that could be recognised. The appearance of the rock itself suggests Lower Carboniferous age; or in other words, rock such as in the coal districts of England is usually found beneath the Coal Measures. (Rocks of a like kind sometimes also occur in the Coal Measures.) But in the absence of recognisable fossils, any guess as to its probable affinities can have but little weight.



NOTE. The dip at Stutton varies from about 40 degs. to vertical.

This rock was pierced to a depth of sixty-nine feet at Harwich, and about 500 feet of it have been passed through at Stutton. But its dip at Stutton is very high, and this must give a very exaggerated notion of its thickness. Perhaps a simple diagram may be useful to demonstrate this point. If the line *a—b* represents the bore-hole through the Paleozoic, or bottom rock, at Stutton, it is obvious that, owing to the high dip, the thickness as given by the boring may be as much greater than the true thickness of the rock, as the line *a—b* is than the line *c—d*.

Assuming that the rock is of Lower Carboniferous age, there is certainly a possibility that here, as in Belgium and Northern France, Coal Measures may be found beneath Lower Carboniferous rocks, owing to the older rocks having been thrust over the newer by a crumpling force exerting immense lateral pressure in one general direction, which has caused a reversal of the beds. For there were very decided indications that the rock at the lower part of the Stutton borehole has been subjected to much pressure of a similar kind. But considering the limited funds at the disposal of the Association, it would seem more prudent to discontinue the Stutton borehole, in order that more money may be available for other borings. For even if coal were ultimately found at Stutton, it would almost certainly be at a greater depth, and less easy to work, than we may fairly expect it to be elsewhere in this area, considering the moderate depth of the Palæozoic rocks alike at Culford, Stutton, and Harwich.

The high dip of the Stutton rock, and the fact that it has evidently been subjected to intense pressure, gives a strong presumption that its character may change in a very short distance horizontally in the direction of its rise or dip. Now, the high dip both at Harwich and Stutton suggest that the line from

Stutton to Harwich is approximately that of the *strike*—or is, in other words, nearly at right angles to the direction of the dip of the beds. We do not know whether the dip at Stutton is northward or southward, but the ascertainment of its direction would give information of much less value there than with rocks not squeezed and disturbed, and dipping at a low angle ; for at Stutton the dip is probably very variable, and the local dip and the general dip may by no means coincide.

As a spot for the next bore-hole of the series, it seems evident that a place some eight or ten miles either north or south of Stutton should be selected, for that distance, while it would probably be sufficient to give a change in the Palæozoic rocks, would not be so far away as to put us out of touch with the results attained at Harwich and Stutton ; for we must not forget that any coalfields which may be locally preserved will be found to owe their preservation to their having been thrown into basins separated from each other by older rocks.

These coalfields are probably of no very great size, and, therefore, if a place fifty or sixty miles from Stutton be chosen for the second boring, it is obvious that it will be impossible to correlate the results obtained with those of Stutton and Harwich.

A good place for the second boring would be somewhere about Great Bentley or Weeley, S.E. of Colchester. For on the one hand it would be a sufficient distance from both Stutton and Harwich ; and on the other it would be a little eastward of the region damaged by the Essex earthquake of 1884, under which district Palæozoic rocks older than Carboniferous are probably unusually near the surface. A greater thickness of Tertiary rocks will have to be passed through around Great Bentley than at Stutton. Possibly, however, there may be less Chalk, and it would be difficult to fix upon a more likely spot for a possible coalfield in this direction.

Northward of Stutton, Bramford, where the Chalk comes to the surface, is as good a place as could be chosen in that direction. There are also wells in the Chalk in the marshes near Orford, which might possibly be utilised for coal exploration, the water from them being brackish. But, in the first place, a boring nearly due south of Stutton, about Great Bentley, and another nearly due north at or near Bramford, seem most worthy of recommendation.

W. WHITAKER.
T. V. HOLMES.

Having examined, with Mr. Holmes, a great extent of the core at Stutton, as well as a great number of specimens sent to me, one is not surprised at the fruitless search for fossils. Possibly, however, the breaking up of further specimens may show something.—W. W.

The Directors, while having the greatest confidence in their geologists' advice, felt it would be well, in the interests of the shareholders of the Association, to have the expert assistance of a mining engineer also, and with that view consulted Professor Galloway, of University College, Cardiff, who visited Stutton, and he has forwarded the following letter, which entirely coincides with Messrs. Whitaker and Holmes's report :

Cardiff, 9th November, 1895.

DEAR SIR,—Since the date of my visit to the bore hole at Stutton on the 5th inst., I have read over all Mr. Whitaker's papers on the subject of boring into and through the members of the Cretaceous formation in the South-East of England; I have carefully considered the appearance of the cores which were obtained from the bottom of the Gault downwards, at Stutton; and I have had some of those samples of the cores which were apparently the most promising broken up and subjected to a minute examination, to see if they contained any fossils or traces of fossils, but without avail.

The rocks passed through consist for the most part of dense dark-coloured clay-slate or slate-like shales, alternating here and there with thicker or thinner bands of very hard, fine-grained, greyish-coloured sandstones, which in some places resemble quartzite. The stratification is exceedingly obscure, and the cleavage is indistinct. There are numerous fissures filled with thin sheets of calcite, which appear to coincide with the planes of stratification, cleavage, or faulting, as the case may be. These rocks have all the appearance of being of greater geological age than the rocks of the Coal Measures. This circumstance, considered by itself, would not be sufficient evidence that they are older, inasmuch as rocks belonging to the Coal Measures, and even to younger formations, are frequently found metamorphosed to such an extent as to be unrecognisable as such. But when it is taken in conjunction with the fact that no traces of anthracite, or coal, or plant remains, or fossils of any kind, have been met with in boring through a thickness of over five hundred feet, I think it is quite conclusive.

Accordingly, I have no hesitation in recommending your Directors immediately to discontinue boring operations at Stutton, as I am of opinion that the Palæozoic floor at this point consists of members of some older formation than the Coal Measures, and possibly belonging to the Lower Silurian.

I am, dear Sir, yours faithfully,
W. GALLOWAY.

While Professor Galloway was preparing his report, the Vivian Boring Company, together with Mr. Graham, carried on a series of experiments of a delicate nature in order to ascertain the "dip" of the rock. This was done by means of specially made apparatus constructed by Messrs. Ransomes and Rapier (Mr. R. C. Rapier being the indefatigable Chairman of the Coal-boring Association), and the information gained by Mr. Graham enables him to decide that the dip is from North to South.

There being a general agreement of geological opinion that the beds pierced by the Stutton boring are in all probability older than Coal Measures, and Mr. Graham's observations having shown the dip to be southerly, it became obvious that the next boring of the series should be south, not north, of Stutton. Accordingly a site for another boring was sought and obtained on the Essex side of the Stour. We are informed by Mr. G. F. Mansell, the energetic

Secretary to the Eastern Counties Coal-boring and Development Association, that the new boring adjoins the Great Eastern Railway Station at Weeley, on the Tendring Hundred Line. Also that at the present date (October 10th, 1896) the boring has attained a depth of 827 feet, the formation in which it is now going on being the Chalk. A thickness of 196 feet of clay, etc., had to be passed through before the top of the Chalk was reached.

We may add that, by the kindness of Mr. Graham, one section of the "core" from the Stutton Boring has been deposited in the Essex Field Club's Museum, and two others have been retained, which are in the Ipswich Museum and the Cambridge University Museum respectively.

THE PROTECTION OF WILD BIRDS IN ESSEX.

THE SHORE BIRDS.

By CHAMPION B. RUSSELL, J.P.

Chairman of the Committee of the Essex County Council for Protection of Wild Birds, and Hon. Secretary to the "Essex Bird-Protection Society."

IN the number for June, 1895, of the present volume of THE ESSEX NATURALIST (*ante*, pp. 42-51) the Editor summed up the result of the Petition of the Essex Field Club to the County Council, regarding the protection of shore birds, and the hopeful position then attained in this important matter. But reference was made by myself (pp. 45-46) to the delay in obtaining the consent of the Home Secretary to the application of the Essex County Council. As East Suffolk had met with a similar rebuff, on much the same grounds, a Conference was held on November 1st, 1895, with the representatives of that county, at which it was agreed that the chances of success would be greater if both counties presented practically identical applications. With this object, as Suffolk had applied for a considerably smaller area, the southern boundary of the Essex area was drawn at Shoeburyness, instead of at Thames Haven; and all ground above Maldon, Wyvenhoe, and Battle Bridge was eliminated. The special application for the benefit of the swallow tribe was also withdrawn. The members of the Conference attended as a deputation at the Home Office, where they had a most friendly reception by Mr. Kenelm Digby (in the absence of the Home Secretary), and the whole matter was talked out, with the result that at last, on February 6th, 1896, the order was actually made.

In the meanwhile a Conference had been held on December 11th, 1895, between representatives of Essex, Norfolk, and East Suffolk, to consider what means should be taken to ensure the enforcement of any order that might be made—a step due to the foresight of Mr. E. N. Buxton, who felt that immediate action was required, if the birds were to be protected during the summer of 1896.

From the experience of Norfolk, where a similar order was already in force, it was determined to form Bird Protection Societies for each county, working on much the same lines.

A public meeting was held at Chelmsford on March 17th, 1896, when it was resolved to form the "Essex Bird Protection Society," *which should direct especial attention to the preservation of the coast area.*

Mr. E. N. Buxton was appointed *President* of the Society, Mr. E. A. Fitch *Vice-President*, Mr. C. W. Parker *Treasurer*, Mr. C. B. Russell *Hon. Secretary*, and a committee was formed, which lost no time in getting to work; with the result that the most important centres have been visited, interest has been stirred up all round the coast, twelve Bird Protection officers have been appointed—men of influence in their districts—whose work lies near the breeding grounds, and rewards have been offered for convictions. It is hoped, however, that the public sentiment, which is growing in favour of the birds, will be more effectual than many prosecutions; for if the local people are keen about their preservation, the egg-stealers will not readily incur the summary punishment likely to be inflicted.

Although attention is especially paid to the foreshores, a great deal is being done by co-operating with the adjacent owners and occupiers inside the sea wall, so as to protect the gulls, redshanks, and wild fowl of all sorts breeding there. It is worth observing that the eggs of wild duck, widgeon, and teal are protected by the Game Laws under a penalty of 5s. for each egg.

Two arguments are raised against the work of the Society: (1.) It is said that the real cause of the birds becoming extinct is the increase of population, and the speed with which people can travel, even to the most remote spots by land and water alike. In this there is an element of truth. Our coast used to be celebrated as the haunt of sea birds; but while the destroying hands have increased, time and distance have been diminished; so that now the townsman can in a few hours make fearful havoc among the nests. The local folk who see what is going on say to themselves: "If I don't take the eggs some one else will"; and between the two, common terns' eggs taken in the morning become prime plovers' eggs before night in Leadenhall Market!

But on the other hand the neighbourhood of man alone does not drive away the birds; in many instances the birds breed regularly close to light-houses and cottages, and that fallacy would soon be dispelled by an inquiry into the number of unpinioned wild-fowl breeding in the London parks.

The truth being that where man is the greatest foe, birds tend to become wilder and wilder; but where man's presence means protection, the most familiar of the species survive the best. For this reason the house-martins are fond of breeding in window-corners, as a home where the sparrows dare not eject them—too often they escape the sparrows only to fall at the point of the housemaid's broom.

No little of the blame lies with what is called the increase of Natural History. If it goes on increasing—which Heaven forbid—it will soon be all ancient history! The ambition of the student is too often fixed upon the possession of spoilt samples of God's gifts; and the love of Nature is swallowed up in the greed of collection. We do not generally turn each other into mummies as a proof of love, nor send our own children to the taxidermist because they are such fine specimens! Some debased species of collector even think it to their credit to own bought samples, with the result that the professional exterminator supplies their demand.

The rarest flowers and insects are ravished by their sacrilegious hands, till sometimes not a specimen remains; and their great success is bought at the price of eternal robbery of God and man.

Sometimes the work of perdition is even done in education's name. The institution of Botany classes has to my knowledge stripped a whole district in Wales of every rare plant. Every precious creation is threatened with the same fate! There is much truth in that interesting story of "An Unexpected Visitor." It would not be safe for an angel to show his wings on earth in these latter days.

(2.) The other argument is that we are too late; that there are so few shore-birds left that they are not worth preserving. After the history of Adam and Eve, religious people are found who say this—without any sense of the humour of their argument! They err in the opposite way to the good alderman who objected to the purchase of "so many gondolas" for the public lake. "Why not," said he, "buy two at first, and let nature take its course?"

The fact is that along the shores and marshes of Essex, Norfolk, and Suffolk many birds breed regularly that are unthought of by the average naturalist; Pochard, Shoveller, Teal, Oyster-catchers, Ruffs, and Reeves, with many other rare birds, have already nesting-grounds within easy reach, and if protected would soon found fresh colonies; but these birds, though delectable to the naturalist and sportsman, can afford but a tithe of the pleasure given to holiday-makers and others by the Gulls and Terns, whose showy habits give life and beauty to our shores. The Gulls have been protected in some few places, thanks to the loving-kindness of private owners; the Terns, whose public nesting-place it should have been every one's business to protect, are sadly diminished in number; but still enough are left to re-people our shores in a few seasons, if they be only left alone.

There are many birds which we hardly dare hope to re-establish at any rate so long as would-be colonists are the mark of every fool's gun; the Bitterns, Bustards, Cranes, and Spoonbill, will hardly rank again as common English birds. Yet there is no doubt these once were common; as were Kites, of which Clusius is said to have seen a most amazing number in London, "that flocked there for the sake of the offal, etc., which was flung into the streets. To kill them was forbidden; and they were so tame as to take their prey in the midst of the greatest crowds." (The description reminds one of sea-gulls in the Liffey.) Such a sight will never be seen again in England; but many places where men still living have gathered great baskets full of sea-birds' eggs are now deserted, simply because no eggs were left to hatch. Such was Peewit Island, of which Fuller in his description of Essex gives so quaint an account.

> "The puits (*i.e.* Pewit Gulls) "being young consist only of bones, feathers, and lean flesh, which hath a raw gust of the sea. But Poulterers take them and feed them with gravel and curds (that is Physick and Food), the one to scour, the other to fat them in a fortnight, and their flesh thus recruted is most delicious."

This glory of our shores and islands may return once more; possibly the young Gulls may even again become an article of commerce; but at any rate there may be enough to rejoice thousands of holiday-makers—as the foreground to the sea picture which they carry in their memories.

The present comparative desolation of our shores may be appreciated by anyone who visits the Bass Rock, or any such paradise of birds protected by isolation or by nature's defences. There, every jutty and coign of vantage holds its nest; the huge white wings of the Solan Goose throng the air and bring back thoughts of childhood's heaven; the birds in the distant sea are in multitude as stars set in a firmament of blue; while now and again in mid-distance some lazy flapping gannet drops to seize its prey like a plummet from the sky. Such a sight must have been in Milton's mind when he describes the creation of the birds beginning with "the tepid caves and fens and shores" whence:

> "They summ'd their pens, and soaring th' air sublime
> With clang despis'd the ground, under a cloud
> In prospect."

At the Bass care is taken not to exterminate the birds, though man takes his toll of the eggs—as do the ruthless crows among the smaller birds.

A Japanese picture of their fleet at anchor has a tern flying off to the left, while a crow is flapping after it on the right-hand side. Probably the painter meant to express in birds the poet's idea of the black wolf Night following the white fawn Day; but to the prosy writer it brought the thought, that in Essex, crows are no longer the tern's worst enemies.

NOTES—ORIGINAL AND SELECTED.

Otters and Badgers near Colchester.—Dr. Laver, F.L.S., writes as follows to "The Zoologist" for July, 1896 (vol. xx. p. 253): "I have within the last month purchased a young Otter and two half-grown Badgers, captured within five miles of Colchester. The Otter, rather under half-grown, was caught by a dog in a small brook at Alresford, Essex, and was offered to me for sale May 23rd, the day it was captured. As it did not seem much injured, I purchased it, and sent it to the Zoological Gardens, fearing if I set it at liberty it might not be old enough to get its own living. The Otter was for many years very rare in Essex, but during the last few years it would appear to be increasing in all our rivers, and is now found, as in the days when Daniell wrote his "Rural Sports," in the reed-beds of our marshes and in the sedges bordering our fleets, and I frequently at night hear its whistle in the river Colne, where it passes through this town. In this river it is becoming fairly common, and as it is admirably adapted for hunting with hounds, a visit from a pack would afford us a new sport, and, I feel sure, would give us great assistance in our endeavours to preserve the race. The

Badgers were caught on May 4th, at Stanway Hall, about four miles from Colchester, by the gamekeeper there, who had a few days previously captured, and unfortunately destroyed, the mother. These animals are not so rare in Essex as they were at one time, for it is not so long since several were caught near Braintree, and there are reasons for suppposing that Badgers have continuously existed at Stanway and the neighbourhood. I purpose keeping these in their native county by setting them at liberty in Epping Forest, if it meets with the approval of the Verderers, to whom I have offered them. They would not have been disturbed at Stanway had not the owner of the Hall, who is an enthusiastic foxhunter, been advised to get rid of them for fear of their injuring the foxes."

A White Hare at Laindon.—Mr. Samuel Hunt, of Southend, records in "The Zoologist" (vol. xix., p. 375), the occurrence on Manning Farm, about 2½ miles from Laindon, during the last week of September, 1895, of a pure White Hare, but with eyes of the ordinary colour. The Rev. J. Conway Walter, of Langton Rectory, Horncastle, communicated to "The Standard" some interesting particulars of Albino and pied Hares in his neighbourhood which are worth putting on permanent record. He writes: "In 'The Standard' of 22nd of September, you mention that a 'true Albino specimen of the Common Hare *(Lepus timidus)* had just been presented to the Zoological Gardens, and that 'such specimens are extremely rare.' In this neighbourhood they are not so rare as is generally the case. Some thirty years ago an Albino Hare was frequently seen in my parish of Langton by Horncastle. Naturalists and others competed keenly for the prize, and it was eventually shot in the adjoining parish. No other case was recorded for several years, although I have myself shot hares with white face, white forelegs, and so forth. Three years ago, however, the principle of heredity seems to have reasserted itself, and several specimens were announced as being seen. A tenant farmer near here, two years ago, secured a half-grown specimen, which was caught while his corn was being cut, and he still has it stuffed. Last year he also caught two Albino leverets, which were given to 'the young Squire,' the owner of the estate, who reared them as pets in confinement.

"Our 'Lincolnshire Naturalists' Union,' of which I am a member, last year established a museum in the Castle at Lincoln, intended especially for objects of natural history connected with the county. I had recently the pleasure of presenting to this museum a very fine specimen of the pink-eyed Albino Hare, caught in the parish. Two small Albino leverets were also given to me, one of them killed by a weasel, the other by a boy; and these three are now being stuffed in one group for the above-named museum. A young man in the neighbourhood, given to naturalist pursuits, is also rearing a specimen in confinement, hoping to breed from it.

"These several cases tend to show that, in this locality at least, this variety of the Hare may be considered permanent. It is to be hoped that collectors may be merciful and not exterminate the interesting family. It may, perhaps, interest your readers to know that I have a fine specimen of a cross between Hare and Rabbit, of which I have shot at different times three. These are really rare."

Albino Weasel at Colchester.—Mr. Miller Christy, F.L.S., writing to "The Zoologist" (vol. xix., p. 19), and referring to the enumeration of Albino specimens of the Common Weasel which have hitherto been recorded, amounting to only seven or eight in the whole country ("Zool." xviii., p. 449), says: "I may mention that some time since Mr. J. Pettitt, taxidermist, of Colchester, showed me a specimen which had been killed near that place about December 20th, 1892.

It was pure white, with pink eyes, and the flesh was of the usual pale colour."

Albino Hedgehog at Wickham Bishops.—A few days ago I captured a peculiar Hedgehog, with light-coloured spines and hair, red eyes, and with pink feet, nose, and ears—very much like a white rat. Have you met with an instance of that kind?—(Miss) J. S. DIXON, Wickham Mills, December 11th, 1895.—[Albino Hedgehogs are undoubtedly of rare occurrence. Specimens have been recorded from Norwich, Kilburn, Bedford, Eton, and Scotland. Charles Waterton once had a family of milk-white Hedgehogs in his park at Walton Hall. We cannot find any previous record for Essex of an Albino Hedgehog, and Miss Dixon's note is therefore of considerable interest.—ED.]

Black Rat at Shadwell.—"As the occurrence of the old English Black Rat, *Mus rattus*, is becoming less frequent every year, it may be of interest to note that a young one, a female, was caught on the business premises of Messrs. S. E. Norris & Co., at Shadwell, East London, in February, 1895. A. D. SAPSWORTH, Woodford Green" (in "Zoologist," xix., p. 105). Mr. T. Southwell records in "Zool.," xx., p. 143, the occurrence of *Mus rattus* in great plenty at Gt. Yarmouth; he considers them to be a recent importation in grain ships, which is the more probable inasmuch as one example sent to Mr. Southwell was not *Mus rattus* but *M. alexandrinus*, an allied (? hybrid) species.

A Strange Foster-Parent—"A rabbit belonging to a young man named Knight, employed by Mr. T. Franklin, butcher, of Market Square, Bishop Stortford, recently became the mother of eight, but unfortunately died. The owner placed the family with a cat, which took to them at once in lieu of her own offspring, and the strange sight can be witnessed of the rabbits obtaining sustenance from their feline foster mother."—"Essex Herald," October 10th, 1896.

Little Auk (*Mergulus alle*) at Lawford.—"The Essex County Standard" recorded, on January 12th, 1895, that "Mr. H. N. Dunnett, on January 1st, shot on Run Stone a beautiful specimen of the Little Auk, which is being stuffed." —[During January, 1895, astonishing numbers of the Little Auk were observed all round the N. and N.E. coasts. Mr. Harting says that "on the 21st of that month great numbers were observed passing south, both at sea and along the coast, and many were cast ashore in a helpless condition, exhausted in their attempts to withstand the stormy weather which has recently prevailed."]

Crossbill (*Loxia curvirostra*) at Lexden, and Albino Starlings at West Bergholt.—I lately saw, at Mr. Pettitt's (our local bird-stuffer) a male specimen of the Crossbill, shot at Lexden on June 2nd, 1895. Mr. Pettitt also had two Starlings, both true *Albinos*, with pink eyes. These were shot on June 15th, 1895, at West Bergholt, and were probably birds of the year.—HENRY LAVER, F.L.S., Colchester, October 11th, 1895.

Cuckoo with Hepatic Plumage (*Cuculus hepaticus*, of Sparmann) at Waltham Abbey.—At a meeting of the Linnean Society on May 2nd, 1895, Mr. J. E. Harting exhibited and made some remarks on the above, and in "The Zoologist" (vol. xix., pp. 257-263) he printed some extended details on this rare form of the female. The bird was shot by a gamekeeper in the grounds of Beech Hill Park, Waltham Abbey. In "The Birds of Essex," p. 153, two other specimens are recorded, one from Upminster, and the other from Ashdon, in Essex.

Probable Solitary Heron's Nest near Ingrave.—Walking across the fields this afternoon to Billericay, our dogs put up a young Heron in the brook by the Qualmstone Spring, between Bluntswell Wood and Bridge Wood, and a hundred yards further on a beautiful, full-grown Heron rose from the same brook. The little one was so small that I think it must have been bred where we found it.—ERNEST W. HEATLEY. Ingrave, July 12th, 1896. [Several instances of solitary Heron's nests are recorded by Mr. Fitch in THE ESSEX NATURALIST (vol. ii., p. 174.]

Kingfishers Killed by Flying against a Window.—Four or five years ago, on two occasions, I found a Kingfisher killed by flying against the bay window of my dining-room. On the 17th of this month a third was found killed under the same circumstances. I may observe that there is no stream anywhere near the house; the only water being a very small pond in the garden, and a village pond at the gate, the house not being in the line from one to the other. —ROBERT WOODHOUSE, Longmead, Writtle, December 19th, 1895.—[The facts here recorded are certainly extraordinary. We have heard before of Kingfishers killing themselves by flying against the glass of windows, but for this to occur thrice, within a short time, against the same window, and without any obvious cause, is unaccountable.—ED.]

Nesting of the Short-eared Owl (*Asio brachyotus*) in Essex.—Mr. E. A. Fitch writes as follows to "The Zoologist" for June, 1896: "I have been much interested in finding a Short-eared Owl's nest on my island (Northey, Maldon), with eleven young ones, three out of the nest, two good snappers, and two just hatched, the rest graduated in pairs. Although I write 'nest,' there really is none, properly so called, the young being on the bare grass against a tussock. My man said two of the eggs were unhatched on May 26th. There are eighteen colts on the marsh, and the way the old owls 'go for' these, my man says, 'is a caution, as good as any dog he ever saw.'"

Snow Buntings at Southend and Canvey Island.—Mr. H. Sharp, of Southend, observes in "The Zoologist" (vol. xx., p, 143) that on March 14th, 1896, he saw four Snow Buntings (*Plectrophanes nivalis*) on the cliff between Southend and Shoeburyness, which he considers a remarkably late date for these birds to remain after so mild a winter. He continues: "I have several times this winter been 'flighting' on the east end of Canvey Island, and there on and about the broken bank and the grassy foreshore, I have invariably met with Snow Buntings; and it is worthy of remark that, with one notable exception, they showed very little white on their plumage."

Great Snipe (*Gallinago major*) at Thaxted.—"On September 3rd, 1896, when at Horham Hall, Thaxted, I secured a specimen of the Great Snipe. It was flushed in a field of clover, and weighed precisely seven ounces. It is in the hands of Messrs. Williams, of Dublin, for preservation. They have informed me that the bird is an adult and one of the most perfect specimens that has come under their observation."—G. A. TEMPLER, Eldon Club, Lonsdale Chambers, Chancery Lane, in "The Zoologist," for October.

A Foster-Mother.—The "Rector of Great Parndon, Essex," wrote on July, 22nd, 1896, as follows to "The Standard": "We all know the story of that beautiful alien, the Cuckoo, how it burglariously enters the nest of another bird not of its own kind, ejects the eggs it finds there from their rightful home, and coolly lays its own eggs in their place, leaving these eggs to be hatched, and the young Cuckoos to be nourished, by the parents whose home has been so ruthlessly violated.

"This is the commonly-accepted belief about the Cuckoo's pleasant ways, but I doubt whether many persons have seen with their own eyes what I saw this morning (at 8 a.m.) on my lawn, viz., two well-grown young Cuckoos, fully fledged and strong upon the wing, and as large as Sparrow-hawks, being fed by a brisk, dapper, intensely energetic, and tiny mite of a Water-wagtail, who hopped about the lawn after worms and flies, and brought the food and put it down the throats of these Cuckoo babies, who were almost large enough to have swallowed whole the brisk little Wagtail that had, no doubt, hatched the eggs, which must have been nearly as big as itself.

"I watched the curious and comic proceeding for quite half an hour, the mite of a Wagtail hard at work all the time searching after the food for these precious big babies. On my stepping out on to the lawn the family dispersed, the two big baby Cuckoos flying away to a lofty tree, and the tiny Wagtail of a foster mother, we may be sure, not far off."

The above communication gave rise to considerable correspondence. "L. T.," writing from Kew Gardens, says: "The pretty sight so pleasantly described by the rector of Great Parndon is quite familiar to me. I remember, as a child, watching a little Water-wagtail busy feeding its great hungry baby on my grandmother's lawn in Somersetshire; and not long since I saw at Cavenham, Suffolk, two young Cuckoos on the lawn, close up to the house, attended by anxious Water-wagtails, who seemed very proud of their fine, noisy children, and were busy from morning till night endeavouring to satisfy their insatiable appetites."

But in refutation of some of the statements of the "Rector," Mr. Arthur Stradling, C.M.Z.S., sent the following interesting letter on the habits of the Cuckoo: "Will it be deemed very ungracious if I venture to point out one or two inaccuracies of natural history in the prefatory note to the most diverting account of the Cuckoo babies and their wee foster-parent as detailed by the Rector of Great Parndon? He alleges that 'it (the Cuckoo) burglariously enters the nest of another bird . . . ejects the eggs it finds there from their rightful home, and coolly lays its own eggs in their place.'

"As a matter of fact, the common Cuckoo lays its egg on the ground (where it often betrays a tendency to some original habit of complete nidification by a rude attempt at forming a depression or enclosure); the single egg is then carried to some neighbouring nest and deposited therein. And here is displayed a marvellous discrimination, intellectual or instinctive, on the part of the bird in selecting a 'clutch' which will most nearly resemble her own very variable produce. This is admirably illustrated in the oological collection of the Department of British Zoology at the Natural History Museum in Cromwell Road, where Cuckoos' eggs, taken from all manner of nests, are exhibited, together with the contents proper. And it is the young bird which ejects its fellow-fledglings, the legitimate occupants of the thus ravished home; its superior size and strength and peculiarly-shaped back enabling it to effect the eviction with comparative ease, and in all cases with certainty.

"This 'odious instinct,' as it is termed by Darwin (who draws a graphic picture of the whole process, with all that is collateral to it, in the eighth chaper of 'The Origin of Species'), is manifested directly the young usurper is free from the shell, even before it can see; and when the true progeny of the nest have been replaced therein by observers, the act has been repeated again and again. Indeed, it must be done early, if at all, in order that the little Cuckoo—a veritable glutton—may get the whole food supply, and may exert its power before its victims develop bulk or muscle for resistance. So much sustenance does the growing Cuckoo require that one egg only, as a rule, is placed in a nest—a rule to which the interesting case given in 'The Standard' evidently offers an exception."

Salmon in the Lea River.—In the "Anecdotal Reminiscences of an Octo-nono-genarian," by the well-known antiquary, Sir G. F. Duckett, Bart., published last year, he records that, when a boy (probably *circa* 1820), living at his father's house at Theobalds, he caught "a *spent* salmon in the Waltham Abbey waters. . . . I was trolling with snap-tackle on one occasion in company with the officer of Engineers then in command of the powder mills, at a part called 'Newton's Pool.' I hooked a good fish, but had little idea of its being other than a pike. At length, however, it was brought to land, and turned out to be what I have said—a *spent* salmon. It must have been there a long time, and had lost all the attributes of a salmon; in fact, looked like a long, thick eel, or something resembling the sea fish ling, but less thick. . . . it measured two feet eight inches. The marvellous part of the matter is, how could such a fish ever have got up the Lea from the Thames? There are endless locks to pass on this navigable river—I cannot say how many—but there the salmon had got, and few naturalists could exactly determine what length of time it would take for a salmon to acquire that peculiar figure—long and lanky, as I have said it was. . . . If in good condition, a fish of that length would have weighed at least thirty pounds." We are indebted to the kindness of Mr. Miller Christy for this extract, which is interesting in connection with Mr. Harting's notes on the former existence of salmon in the Lea in the last volume of THE ESSEX NATURALIST (vol. viii., pp. 197, 198). It may also be noted, as an additional reference, that in Chauncy's "History of Hertfordshire" (1700), the author says that in the Lea there were "some salmons. . . . and if these Fish had free Passage by the Mills, and thro' the Sluces at Waltham up the Stream towards Ware and Hertford, where they might spawn in fresh Water, and were carefully preserved from Pochers, they would greatly increase in that River, and be of great benefit, as well to the City of London as the Country; for some water-men have observed, that they delight in this stream and play much about those Sluces near Waltham." Lieut. Croft, F.L.S., observed in his notes on "Izaak Walton and the River Lea" ("Trans. Herts. Nat. Hist. Soc.," vol. ii., p. 14), that "in anticipation of a good time coming, the Lee Conservancy forbid the capture of any salmon of less than four pounds' weight"!—ED.

Acanthocinus ædilis, Linn., at Plaistow.—Mr. W. J. Clark, of 179, Harold Road, Upton Park, E., writes on October 17th: "The enclosed specimen of a Longicorn Beetle (*A. ædilis*) was found in a timber-yard at Plaistow a few days ago. According to the Rev. J. G. Wood, 'the insect is rare in England, but is comparatively common in several parts of Scotland, where it goes by the name of the "Timberman," on account of its habit of gnawing wood.' I send the beetle to you, as you may like it for the Museum at Chingford. Of course, it may have been imported, but it was certainly captured in the county."

Acherontea atropos and Sphinx ligustri at East Mersea.—A chrysalis of *A. atropos* was brought to me at East Mersea on August 15th, found while digging up potatoes. Specimens occurred a few years ago, but the insect is not often seen on the island. The "Death's Head Moth" appears to have been much commoner than usual in several parts of England this season. I may mention that *Sphinx ligustri* also occurred on the island.—B. G. COLE, Buckhurst Hill.

Abundance of Arctia Villica on the Essex Coast.—While strolling along the long stretch of sandy shore between Brightlingsea and Colne Point with Mr. G. E. Vaughan on Easter Monday last (April 6th) we observed the larvæ of the "Cream-spotted Tiger Moth" literally in hundreds. Some were feeding on the chickweed; others sunning themselves high up on the stems of the Sea Blite (*Suæda*). I was informed that it was equally abundant all along the Essex coast. It is by no means usually a common insect, but I am told it occurred in like numbers on our shores some years ago. From the larvæ collected I have since bred some remarkably fine specimens, including several variations from the type form.—B. G. COLE, Buckhurst Hill, Essex.

Catocala nupta with Black Underwings.—It will be remembered that Dr. Laver recorded in THE ESSEX NATURALIST for 1888 (vol. ii., p. 255) the capture of a specimen of the "*Red* Underwing Moth" with *black* underwings at West Bergholt. This form is very rare, but in "The Entomologist" for October Mr. Sidney Cooper, of Hawkwood, Chingford, writes that on August 17th he caught a similar specimen at Chingford; and at a meeting of the City of London Entomological Society on September 15th, Mr. J. H. Smart exhibited a fine specimen of the aberration which he had bred from a larva taken amongst others off Poplars, at the Crossness outfall, Belvedere, Kent, about the middle of last June. The larva was fed on poplar, and the moth emerged on July 18th. According to Mr. Tutt. this melanic form (known as "Aberration *cærulescens*") has only been observed on one other occasion in addition to the above, viz., by Mr. Winkley at Mitcham ("Brit. Noct.," vol. iv., p. 131).

Wasps Killing Flies.—In "The Irish Naturalist" for October (vol. v., p. 272), Mr. R. M. Barrington, of Bray, records some observations on Wasps catching the flies settled on cows, biting off the wings, and flying away with the bodies. He estimated that in twenty minutes between 300 and 400 flies were caught on two cows lying close to where he stood. Alluding to this observation, our Vice-President, Prof. R. Meldola, writes as follows to "Nature" of Oct. 15th:

"I am glad you have again called attention to the useful part played by Wasps in keeping flies in check. Many years ago, in an inn parlour on the Essex coast [St. Osyth, August, 1880], I made a similar observation with Mr. W. Cole, who was with me at the time. We found hundreds of wings scattered about the window-ledge inside the room, and we were at first at a loss to explain the depredation. While watching, the mystery was solved. The upper part of the window had been left open a few inches, and a Wasp came through, caught a fly on the glass pane, instantly clipped off its wings, and flew out of the open upper part of the window with the body. Other Wasps followed and repeated the process. For about an hour we observed the continuous arrival of Wasps, every one of which secured a fly before departing."

Since the above mentioned occasion I have repeatedly observed this habit of Wasps, and it was particularly noticeable during the summer of the great Wasp-year, 1895. They would come into the rooms at meal-times and boldly take the flies off the table-cloth and from the windows. On one occasion, while my brother was setting out insects, a Wasp came in at the window, and nipped off the body of a Geometer which had been braced down on a setting-board! Mr. Fitch recently informed me that he often observes Wasps engaged in shearing off the wings of flies at Maldon. The habit of Wasps carrying off bits of flesh from butchers' shambles is a matter of common observation. As "Nature" puts it "perhaps these narratives of good deeds accomplished. will lead people to think more leniently of the vices of the Wasp."—W. COLE, Buckhurst Hill, October, 1896.

Essex Plants.—The occurrence of the following plants in Essex may be worth noting; it is many years since they have been seen in this county: *Salvia pratensis*, L. Found in a field at Fairstead, by Dr. Gimson. *Valerianella* *auricula*, D.C. By Mr. E. E. Turner, at Coggeshall. *Lamium incisum*, Willd. This form or species has been found at Walton-on-Naze, by the Rev. J. D. Gray —J. C. SHENSTONE, Colchester.

Epping Forest in the Sixties.—In the "Cornhill Magazine" for March, 1864, vol. ix., pp. 350-6, there is an article on "The Forest of Essex." Speaking of the privilege of woodcutting (top-lopping), the writer remarks (p. 353): "It is continued to this day in certain parishes, and the consequence is that such a thing as a real natural tree is hardly to be found." He then adds: "It is very surprising in such a wood as Loughton, where there are more than a thousand acres of waste, and perhaps a million of trees, to note how not a single one escapes lopping. The visitor from London, walking there in the summer time, when the lopping is not taking place, and there is nothing to call the villagers into the wood, is struck with the silence and the solitude; but if he begins to indulge any fancies about primeval wastes unspoiled by man, a glance at the trees will correct him. They are not, strictly speaking, trees at all, but strange, fantastic vegetable abortions. Their trunks, seldom more than a foot or eighteen inches in diameter, are gnarled, writhed, and contorted, and at about six feet from the ground, just within reach of the axe, they spread into huge overhanging crowns, from which spring branches which are cut every other year or so, and never long escape the spoiler; then, baffled in their natural instinct to grow into branches, the trees throw up spurs and whips from their roots, and every pollard stump—more or less rotten at the core—is surrounded with a belt of suckers and of sprew. Enchanted bands of Circe's transformed revellers, struggling Laocoons, Dantean forms in pitiless Infernos—the general effect, particularly in the season of wild flowers, is something strangely weird, and, in a sense, intensely beautiful; but it is no more nature's notion of primeval woodland than are closely-cropped hair and shaven lip and chin her intention for the real expression of the human face."—Extracted by MR. T. V. HOLMES.

Vitality of Seeds.—"I think I ought to have told you of an instance of this that has come under my notice this year in Norsey Wood. Last winter I opened one of the Bowl-shaped Hollows, which I told you of, by excavating a deep trench diametrically through it, down to the maiden soil below, some eight feet below the surface. I have very frequently visited the spot all through the spring and summer till now. In August, a few weeks after the heavy rain which ended our long drought, I was struck by several lines of plants shooting from the several layers of darker soil (apparently vegetable mould) which my trench had cut through vertically. These were the Common Foxglove, and the lowest layer of them must be not less than three feet below the lowest part of the bowl before it was opened. Here the upper layers seemed to overhang, so that the plants seem to have grown out of a recess in which no seeds could well have been recently blown or lodged. The keeper (J. Bellingham) was very much surprised. He states that 'there have been no Foxgloves growing in this part of the wood for some five years past.' If, as it seems, the seeds were deposited when the dark layers of soil were formed, the lowest must have lain dormant for many scores of years, perhaps for centuries."—(GENERAL) B. R. BRANFILL, Billericay, October 4th, 1895.

The Essex Earthquake of 1692.—Mr. Henry Stopes has found a MS. book "in the library of Colchester Castle," which appears to have been the Commonplace Book of Thomas Witham, who in 1610 was appointed rector of Mistley-cum-Manningtree In this book there is a reference to the Colchester earthquake of

1692, which is spoken of as occurring on Sept. 8th of that year, twelve or thirteen minutes after two o'clock in the afternoon, and lasting about one minute, making most people who were sensible of it giddy for some time afterwards. This account tallies exactly with the record of the same event preserved in the register of St. Peter's Church, Colchester, in the handwriting of the then vicar, Rev. Robt. Dickman, quoted *in extenso* in Messrs. Meldola and White's "Report on the East Anglian Earthquake," pp. 11-13, wherein the earthquake is stated to have lasted "for the space of a minute or more." The story of an earthquake lasting a minute or more has (writes the editor of "The Essex Standard," from which we quote) generally been somewhat ridiculed, but after all it receives confirmation in this independent version of Thomas Witham's Commonplace Book, so that probably the shock was one of a totally different character from the short, sharp disturbance of April 22nd, 1884.

Earth Noises and supposed Slight Earthquake at Mersea and Colchester.—During occasional visits to Mersea for the last few years, the members of my family have noticed mysterious noises apparently coming up from the earth, heard on quiet days, and especially at night. Last Augnst I myself repeatedly heard these sounds. Our cottage is close to the coast-line at East Mersea, about four miles from the village of Peldon, where occurred one of the maxima of disturbance in 1884. As stated in my letter in "The Standard" of September 7th, the noises resemble in "some cases the slamming of a heavy cellar door, and in others the shooting down of a load of coals or stones. During the latter half of August I occupied a room on the ground floor of one of the cottages, and repeatedly at night had opportunities of hearing these noises, and of satisfying myself that they were subterranean, and were not thunder nor the result of the firing of guns, as might at first be suspected. There are no cellars underneath the cottages, and East Mersea is an exceedingly quiet island, separated by a broad estuary from a railway or other sources of vibration.

"On inquiry of the country folk in the neighbourhood, I found that these subterranean noises were matters of common knowledge, and had been often noticed this year by them when ploughing in the fields—they called them 'earth-gruntings.' I am also informed that at Peldon, which suffered so severely from the earthquake of 1884, similar noises have been heard, and that on more than one occasion recently, pictures hanging on walls have been misplaced, and articles on tables moved out of position without apparent cause."

It would only be by the aid of delicate instruments that reliable information could be obtained as to the source of these noises, and to answer the question whether real earth-tremors accompany them. Judging from my own experience, and from the observations of my neighbours, I am strongly inclined to connect these "earth-gruntings" with seismic disturbances. I am hopeful ere long to obtain the loan of a seismograph, and so be enabled to register accurate data. At present I simply put the above observations on permanent record.[1]

It is interesting to note that on September 10th, according to "The Essex Telegraph," four distinct shocks, which are attributable to slight earthquakes, were heard in Colchester. The newspaper records the experiences of several people living in Papillon Road, South Street, Crouch Street, at Lexden, and elsewhere all decidedly pointing to phenomena that could be explained on the theory that a slight earthquake had happened. The most detailed and precise account is that given by C. O. G. Becker, Esq., M.D., of the Minories, East Hill, Colchester, which is as follows :

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[1] A long correspondence was carried on in "Nature" at the end of last and beginning of this year, concerning remarkable sounds heard in various parts of the world, some being known as "barisal guns" or "mist pouffers," which appear to be of atmospheric origin, or, at least, are promulgated from the surface of the earth, while other sounds are described which more nearly resemble those I noticed in Mersea, being of a subterranean nature. No very confident theories have been broached with regard to the origin of these sounds, which, indeed, may not be the same in all cases; but the whole correspondence is very interesting, although too long and full of detail to be summarised here. W.C.

"On Thursday, Sept. 10th, at 12.5 p.m, I was sitting in my library with my eldest son, when there came a peculiar sound, more like the discharge of a 110-pounder gun. It came from the south or south-west. There were two downward shocks, with a strange noise. My daughter rushed into the room and said, 'The house is coming down!' We searched all over, but could find no damage in the house, though all the windows of the room shook. As we were coming down from the top of the house there was a second discharge of these noises, and the rumbling and downward moving came again. We went into the garden to see if anything could be seen there, but could not discover anything. I said to my son, 'It is an earthqdake; it is not a discharge of heavy artillery,' remembering well the sound it made in 1884. It continued, and made five distinct discharges of these peculiar noises, and with the last one there were three downward movements like a heavy weight coming to the ground. There was a heavy downpour of rain, and the barometer was exceedingly low, standing at 29. My house was damaged hy the earthquake of 1884, so that when these five shocks came it made me feel a little creepy. It is no joke to be buried under a heap of ruins."

The narratives of the other observers recorded in "The Essex Telegraph," all speak of distinct vibrations, windows rattling, bottles "jumbling," etc., accompanied by a rumbling noise. Of course the usual suggestions have been made that the vibrations and noises were caused by the discharge of "heavy guns" or "torpedos," but no evidence of this is forthcoming, and careful and extensive inquiry by the reporters has failed to obtain any such evidence. The only cccurrence which seems in any way connected with the phenomena at Colchester is the explosion of globular lightning (or was it a "bolide"?) at Hatfield Peverel, about fifteen miles from Colchester, which we record in another paragraph below.

In THE ESSEX NATURALIST for 1892 (vol. vi., p. 101)), we recorded observations by Dr. Thresh of a supposed earthquake shock at Chelmsford on May 27th, 1892. and in doing so we made the following observations, which we now emphasise, as equally applicable to the notes printed above : "It is much to be regretted that no instrumental record of these vibrations is yet possible in Essex. Since the great earthquake of 1884, several shocks have been noticed; but as they were all too slight to move objects, or to cause any structural damage, it was always open to the sceptic to suggest big guns or atmospheric disturbances as the cause. We think it desirable, however, to put on record all observations from skilled scientific observers such as Dr. Thresh."—WILLIAM COLE, Buckhurst Hill, Octoher, 1896.

A "Bolide," or Globular Lightning Discharge, at Hatfield Peverel.—Mr. Edward Gibson, of Hatfield Peverel, writes as follows, under date September 10th, to "The Essex County Standard" :

"In the present very unsettled state of the weather, some of your readers may feel interested in the following account of a by no means pleasurable sensation experienced this morning by the inmates of this house.

"I was writing in the dining-room on the south side of the house, and shortly before the occurrence remarked how very oppressive it was, all doors and windows being open. One of our guests remarked 'We shall have an earthquake.' A few minutes later, at twelve minutes to twelve, there was a vivid flash of lightning, which seemed to fill the room with fire, accompanied by a tremendous crash like the bursting of a shell. The crash and flash were instantaneous and simultaneous. I thought that the house had been struck by lightning, was probably on fire, and feared that some of its inmates might have sustained serious injury. I ran into the hall, which was already thronged with anxious faces, and noted that the park in front of the house, on the north side, was full of smoke. The rain came down in torrents for some minutes. As soon as it moderated, we sallied forth, and soon found traces of the explosion. The bark of an elm tree, sixty yards to the north-west of the house, had been torn off in several places, and hurled about in thick rope-like lengths; the posts of the park gates, thirty yards to the north east, had both been struck, the one in two places with slight damage, the other stripped as if by a shell, blackened and burnt splinters being scattered hither and thither in every direction to a distance of sixty yards or more.

"I think it probable that the aerolite exploded at the height of some fifty feet from the ground, on the north side of the house. The distance between the elm tree which was struck, on the north-west side, and the park gates on the north-east is about one hundred yards. The smoke which followed the explosion hung between these two points for some minutes. Every one in the house seems to have experienced the same sensation of being surrounded by fire. A herd of cows feeding in the park were terrified and careered madly away."

Rainfall in Chelmsford, January to July, 1896, compared with Average for Twenty-Eight Years. — Mr. Symons, in "The Times" of August 3rd, compares the result of the rainfall in London for the first seven months of the year for the last thirty-seven years, comparing it with the rainfall of the same months of this year. My record only goes back for twenty-eight years, but the result as far as this part of the country is concerned may be of interest to some of your readers.

	Jan.	Feb.	Mar.	April.	May	June	July	Total
Average of 28 years from 1868 to 1895 inclusive... ...	1·70	1·46	1·37	1·34	1·65	1·73	2·36	11·61
1896	0·62	0.64	3·04	0·49	0·17	3·24	0·63	8 83
Excess...	—	—	1·67	—	—	1·51	—	Net deficiency in 7 months.
Deficiency	1·08	0 82	—	0·85	1·48	—	1·73	2·78

This shows that our deficiency is only about half what Mr. Symons' records prove it to have been in London, and I am not sure that in itself it would have been very serious; but the important point, as far as we are concerned, is that the deficiency follows an exceptionally dry year, and also a series of dry years. I find that the average rainfall of the ten years, 1876 to 1885, was 25·23, whereas the average rainfall of the ten years, 1886 to 1895, was only 21·00, and the rainfall of 1895 was only 17·45. The average rainfall for the last twenty-eight years is 22·90, so that if we deduct last year's rainfall from this average we have a loss of 5·45, which added to 2·78, the loss on the first seven months of this year makes a total loss of 8·23, nearly 8¼ inches in nineteen months.—Fred Chancellor, Chelmsford, August 5th, 1896.

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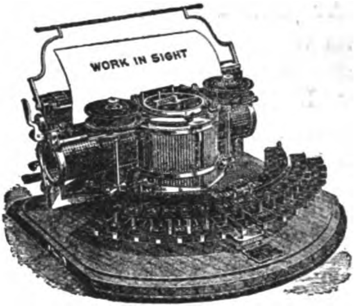

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"*My book is Nature, and it is always by me if I want to read the works of God.*"

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Locke.

"*There is nothing, sir, too little for so little a creature as man. It is by studying little things that we attain the great art of having as little misery and as much happiness as possible.*"

Dr. Johnson.

"*Thus neither the sensual mind, has any occasion to contemn experiments as unpleasant, nor the idle as burdensome, or intollerable, nor the virtuous as unworthy of his labors. And the same influence they may have, on all other moral imperfections of human Nature. What room can there be for low, and little things in a mind so usefully and successfully employd? What ambitious disquiets can torment that man, who has so much glory before him, for which there are only requir'd the delightful Works of his hands? What dark, or melancholy passions can overshadow his heart, whose senses are always full of so many various productions, of which the least progress, and success, will affect him with an innocent joy? What anger, envy, hatred, or revenge can long torment his breast, whome not only the greatest, and noblest objects, but every sand, every pible, every grass, every earth, every fly can divert? To whom the return of every season, every month, every day do suggest a circle of most pleasant operations? If the Antients prescrib'd it as a sufficient Remedy, against such violent passions, only to repeat the Alphabet over: whereby there was leisure given to the mind, to recover itself from any sudden fury: then how much more effectual Medicines, against the same distempers, may be fetch'd from the whole Alphabet of Nature, which represents itself to our consideration, in so many infinit Volumes!*"

Bishop Sprat's *History of the Royal Society of London for the Improvement of Natural Knowledge.* 1667.

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Honorary Secretary and Curator.

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The *Essex Naturalist* contains (in addition to reports of the proceedings of the Club) PAPERS and NOTES ON NATURAL HISTORY, GEOLOGY, and PRE-HISTORIC ARCHÆOLOGY, having special reference to Essex, or interesting to Field Naturalists and Geologists.

Short Notices will be given of Books, new and old, likely to be useful to the amateur naturalist, both in the field and at home, as well as hints and aids on the study of NEGLECTED GROUPS of Animals and Plants occurring in the district.

The *Essex Naturalist* will be found of interest not only to residents in Essex, but also to FIELD NATURALISTS in the LONDON DISTRICT, and to frequenters of EPPING FOREST, where, in Queen Elizabeth's Lodge, Chingford, an illustrative Museum has been established by the Essex Field Club.

Contributions.—The Editor will be glad to receive communications relating to the above-named subjects; also Books and Papers for notice in the Journal, and cuttings and extracts from periodicals and newspapers, furnishing information respecting the occurrence of new or uncommon plants or animals, the exposure of new geological sections by railway or other works, new well-sinkings, discoveries of archæological interest, &c. In short, any material will be welcomed which may fairly be claimed as coming within the scope of the Journal.

All communications, books for notice, &c., should be addressed :—

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A few Advertisements can be inserted; for terms apply to the Editor.

THE

ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club

FOR 1897 AND 1898.

(VOLUME X.)

THE ESSEX FUNGI AND HOW THEY SHOULD BE REPRESENTED IN THE EPPING FOREST MUSEUM.

By M. C. COOKE, M.A., LL.D., A.L.S., &c.

[*Read November 21st, 1896.*]

NOW that an Essex Museum at Chingford is an accomplished fact, it is a feasible subject for enquiry, what *is* to be done and what *can* be done in connection with it for the Botany of the Forest District. Indeed, this was the first suggestion which occurred to me on my first visit to Queen Elizabeth's Lodge, and it has recurred several times since. Unfortunately, the answer to such a question must be modified, so as to come within the limits of the possible when funds are rigidly limited. I wonder when funds were *not* limited in connection with a local museum, for in my own experience it is the first observation always made in such Institutions whenever suggestions are offered in favour of additions or improvements, especially when those suggestions relate to objects which are not popularly attractive, and are only acknowledged to be of educational utility. In all museums, even in our great National Museum, the Botanical portion is relatively very small, very meagre, and very uninteresting. Even when great efforts, and good results are manifest, as the consequence of some abnormal stimulus, in Zoological Departments, there is seldom a corresponding improvement in the Botanical section. The "cold-water *douche*" comes over the ears of the plant enthusiast in a strain of disparagement. What have you to show which will compete with a case of butterflies, a cupboard of stuffed birds, a five-legged calf, or the fin of a sea-serpent? Surely a cabinet of fresh water shells is more interesting than a pile of dried leaves, or even a bunch of mistletoe, at any period of the year except Christmas. Truly, the plant hunter must confess himself at a disadvantage, and that the popular current sets in strong against him, but it is worth enquiring whether Essex people and the Essex Museum is not superior to Mrs. Grundy, as it has shown itself superior to such things as "An Australian boomerang," "The paddle of a Fiji canoe," and "A Zulu assegai." Having had the moral courage to insist that a Local Museum should be *local*, the Club will doubtless go forward, and progress in the march of improvement, by giving equal rights and equal privileges to all departments of Natural History.

It is only just that before any supplementary suggestions are offered, some recognition should be made of what has already been done, both by way of encouragement, and for the information of those who have not taken the trouble to go and examine for themselves. I am personally unacquainted with any of the details of the arrangements hitherto, and therefore all praise or blame must be taken as impersonal, and not intended for any individual, who will therefore pick up for himself all that belongs to him.

At the entrance, and upon the stairs, we find a botanico-entomological series which is very *apropos* to a museum so closely associated with Forest land. This is the collection of *galls*. Although only a nucleus, even of the galls of the forest, it is of great interest, and will, it is hoped be extended, by means of the combined interest of the entomologist and the botanist. If any suggestion could be made, it would be the addition of enlarged figures of the insects, such as those of the "Oak-spangles" figured in *Science Gossip*, many years ago. This would be an additional attraction to the novice, visiting the museum only for amusement. Allied to this subject another suggestion might be made affecting entomologists and botanists alike. This would be a collection of leaves and leaf-miners, with their names and orders, on the basis indicated by Stainton in his paper contributed to *Science Gossip*.

Before proceeding further with suggestions, it will be sufficient for a visitor to enter the large room, and pass over to the opposite side, to convince himself that *plants* have, to the full, a fair share of the room to be disposed of. The illustrations of the orders are ample and excellent, and the dried plants instructive, especially in showing that dried flowers need not be flattened and compressed like hay, or as if they had been put in the family Bible, and sate upon for a week. In this connection we may hope, in course of time, to see sections of timber from the forest, not only showing the useful woods, but also illustrating the parasitism of the mistletoe, the effect of wounds, the ravages of rot, the perforations of the *Cossus*, the mining galleries of beetles, and other external circumstances affecting forest trees, with which the Club has members who are familiar, and who could render valuable service in their collection.

By this time it will be anticipated that my own "fad" will struggle into the light, and that I should be prepared to advocate some sweeping suggestions affecting Cryptogamic plants. Confessing to some monomaniacal tendencies in that direction, it is not clear that any man, in his senses, would be found to advocate giving too great a prominence to any one section in a small museum. As it is, Botany has a fair share of the room, and the Cryptogamia, although equal in numbers to the Phanerogamia, must be far below them in general interest and utility. Hence, with the present space, all suggestions shall be restricted within the narrowest limits.

Educationally, perhaps, it might be well to exhibit types of all the primary groups of Cryptogamia, such as Marine Algæ, Diatoms, Lichens, Fungi (in some respects), Hepatics, Mosses, Ferns and allies. Just sufficient to show how they differ from each other, and what the principal characteristics of their structure. Of course, whilst on this phase of the subject, there could be no valid objection to a Herbarium of the Essex Cryptogamia, as a *reference set*, but not for public exhibition. It would be possible to include all within a reasonable compass, but the difficulty would be to *get* them, and the experts to collect and determine them. Possibly that suggestion will bear fruit in the near future.

Confining observations to the Museum as an exhibition, and what is possible, or feasible, these suggestions will not travel beyond the Cryptogamia. One cannot but regret, in this connection, that the wall space is so exceedingly limited. There is absolutely no room for efficient diagrammatic illustration. It would be hard to find a room with as much floor space, and so little wall space, which is an initial difficulty in a museum. But, we are compelled to accept things as they are, and return to our subject.

Algæ, inasmuch as Essex has a coast line, are within limit, and might be recognised by examples of Bladder-wrack, some Red-weeds (*Floridea*) and *Ulva*, accompanied by drawings, showing details of structure and re-production. Desmids and Diatoms, if there were only room enough, might occupy a square yard of wall space in diagrams.

Lichens could not be summarily dismissed, yet I fear that I am ignorant of the extent to which they are represented already. There are specialities which would suggest themselves to a collector, such as the Reindeer Moss, "Old-man's Beard," certain *Cladoniæ*, and Lichens which have been used in the Arts, such as dye lichens, or in medicine, as *Sticta pulmonaria* and *Peltidea canina*. Not forgetting *Collema* and *Nostoc*, or the necessary illustrations of structure and fruit, of course including the wall space.

Fungi have already more than their legitimate proportion of space, although I should *not* be the traitor to confess it, and yet there is something wanting, and that is the ocular demonstration of the variety of the groups included within the general term *Fungi*. Your ninety and nine visitors out of a hundred can get no further in a mental definition than a "mushroom" and a "toadstool," and these together, represent Fungi—"these and nothing more." If "'Arry" brings his "'Arriet" into the museum on Easter Monday he does it for a "lark," or out of curiosity. He is not in the "pursuit of knowledge under difficulties;" he is only running after "four ale" and noisy pleasure, mixed with a little horseplay and reckless mischief. Supposing that for a brief space of time, you let him forget the main business of his holiday, admit him to the museum with a laugh, and let him out to think. No harm will be done, and he may be educated a little against his will. But—how is it to be done? Not by Latin names in couples fixed upon strange objects, but here and there by something he can understand, when it is explained in plain English. One thing he might see would be a group called "Fungi," either the real thing or a picture, but at any rate *an ocular demonstration*, that under the general name of Fungi, there are Toadstools, Puffballs, hard *Polypores*, *Peziza*-cups, Morels, Dry-rot, Blue-mould, "Candle-snuffs" Smuts, Rusts, and a number of parasites which infest and destroy plants and animals; so that, if he only gets a new idea of the meaning of one word, he will have been educated ever so little against his will. It may occur to some of you how far the Museum may become educational, either as a whole, or in parts, even as the National Natural History Museum is becoming more educational every year by matter-of-fact illustrations of the life history of our native birds. Take an entomological illustration as an example. Let us suppose our visitors are attracted to a group by the sight of a very large caterpillar, and they draw near for closer inspection. "Lors, there's a big hole in that chunk o' wood, and the head of one of them creepy things looking out." "No! yer fool, he's creeping in!" "Does he live in there?" "In course he does." Let's read what it says. "This is the caterpillar, or grub of the *Cossus* moth." "Crikey, 'Arry, it's rum grub!" "Go on! Well! 'he bores into the trees and lives there three years, and eats all the time, till he kills the tree! And then he changes into a 'pup?' "No, stupid! that's not 'pup,' it's *pupa*, like one lying beside it, and it has no legs, and no mouth, and eats nothing, but rests till the time comes to break it's shell, and come out a 'blooming' moth. There he is, 'Arriet, what a wopper for a clothes' moth! Let's see what it does after that. It lays more than a hundred eggs, and then dies. Sarve's 'im right, but that ain't all, for the ticket says as how the Old Romans, a thousand years ago, used to fatten these grubs, and cook 'em for lunch.'" And is that all! It might be, but it is probable that an incident of this kind would cause the couple in question to look more closely at other exhibits, and send them out thinking, or at least having learnt something, which would form a topic for conversation when the holiday is over.

Returning to our Fungi, it may be asked of us, what more is wanting that could be readily obtained; and I would suggest that there are large Woody Fungi of the genera *Fomes*, *Dædalea*, and *Trametes*, which do not shrink, change colour, or decay, and after soaking in a solution of corrosive sublimate might decorate the Museum for many a year.

Not only for exhibition, but for reference, and as vouchers for the Forest Flora, there are a vast number of species which could be represented by careful drying, and mounting, as specimens are mounted for a Herbarium, and preserved in cases or boxes for consultation.

Whatever may be the fundamental principles which guided the promoters of this Museum, it may be taken for granted that they recognise its *dual character*. That they have proposed, in the first instance, that it should be educational, or rather, let us say, that it should be a public exhibition of the Natural History, including the Anthropology of the Forest, as well as, to a certain extent, of its antiquities; but at all events an Exhibition, which should be *local*, not as regards the Forest, but local as regards the County of Essex, and as *educational* as the funds and other circumstances would permit.

The other phase of its dual character, is, as we imagine, that it should constitute a repository for the Flora and Fauna of Essex. That, whilst on the one hand it should appeal to the general public, on the other it should secure the interest of the *Essex Naturalist, and Man of Science.* At present the energies seem to have been addressed to the development of the first phase of its character. To the latter, future effort will have to be directed. It occurs to me that if this centre is to be scientific as well as of general interest, it should include, if *not* a Herbarium of the flowering plants of the Forest and county, which might be too bulky, and less essential, at least some attempt at collecting and preserving the Cryptogamia of Essex, as being far more valuable than mere lists, for recording the Flora of Essex. I would not suggest anything too ambitious, but rather that a commencement should be made in a humble way, to establish a county record.

No one would deny that a collection of the Insect Fauna of the county would be valuable, and that after all it could be compressed within a limited space, but this I leave to the Entomologist. In the same way, and to the same extent, might the Cryptogamia be compressed, and prove in future times a valuable aid to the County Historian. It seems to me possible to preserve and mount dried specimens of the Algæ, Lichens, Minute-Fungi, Liverworts, Mosses, and their allies, on quarto stiff paper, one sheet to each species, and enclose these in portfolios, which could be arranged on shelves, after the manner of books. By this means, gradual development is possible, because the sheets could be intercalated, and arranged in order, like a pack of cards, and additions always made without trouble, so that the growth might be gradual, and the expense small in any one year. Additional paper and additional portfolios would only be required when those previously acquired are all used up. Moreover, in this state they would always be available and useful, even in the most fragmentary condition, for consultation and study.

As to the extent to which Fungi could thus be represented, I am not prepared to advise the attempt with the fleshy fungi, or even the large indurated ones, but to rest content at first with limited groups, such as the *Uredines* or Rusts, and the *Ustilagines* or "Smuts;" these could be preserved well, would lie flat, could be kept free from injury from insects, and would always retain their characters, so as to be of service for reference. These being satisfactory, and fairly complete, another group could be added, such as the foliaceous, or rather the Epiphyllous *Sphæronemei*, and these again by the folicolous *Sphæriæ*, so that at any time the expense would be limited, the attention of collectors concentrated, and the demand for space small. All that would be wanting would be the willing hands, ready to *do* something more practical than talking.

The Liverworts might be treated in the same way, and prove a nice little group within the compass of any lady or gentleman with a moderate amount of intelligence and industry.

No one would dispute for a moment that Mosses are admirably fitted for this kind of treatment, and would make a most attractive album, capable of almost any amount of elaboration. Whilst even it might be prudent to commence with *Sphagnaceæ*, with the aid of Dr. Braithwaite's *Monograph* and afterwards proceed gradually with the rest.

These suggestions do not appear to be so very Quixotic, so incapable of realization, but rather eminently practicable; provided those enthusiasts could be found in sufficient number to carry them out. The sort of people who are not afraid of a little *work*, even if there is no *pay* (and there used to be such people in my younger days).

It may only be a matter of detail, but whatever else is done, it is imperative that all due precautions should be taken to prevent injury to the contents of the Museum by *damp*. No pains should be spared to insure a *persistent and permanent dryness*, or all other labour will be in vain.

Although thankful for small mercies, it seems to be a pity that so important an Institution as a County Museum, should be limited within so small a space. Seen from the outside, and then seen inside, the result was, in one case at least, rather disappointing. When the possibilities of the future are contemplated, a sigh of regret is sure to come. How can a satisfactory result be obtained within such narrow boundaries? It is evidently *not* a question of how to get enough material to fill the space, *but how to find space enough for all the material which could be accumulated.*

Any one who knows the Forest must feel that the Forest alone could furnish interesting and valuable botanical material sufficient to fill all the present room. It is always prudent to attempt to walk, before trying to run, but the walking has been done, and the child wants to go a-head. When suggestions are made, or a visitor is desirous of offering suggestions, or even proffering help, the desire is checked and almost smothered by the reflection that it is in vain to think of additions or proposals when every corner seems to be reasonably full. We are not deceiving ourselves, or making a vain boast, if we affirm that four times the present space could soon be profitably filled with the spoils of the Forest in all departments. It is *then*, and in the New Era, of the "good time coming," when we shall be able to show to our children real stuffed specimens of all the Birds of the Forest, to point out to them the Badger, and the Otter, or the bones of the Wolf, or even rebuild the skeleton of the primeval Elephant from its grave at Ilford.

Of course Essex has plenty to show in a local Museum, plenty dug up from the past, as well as selected from the present, for the instruction of the future. Above all stands that bogie "wall space" for if it were not that, we should be thinking of large Photographs of Forest scenery, of Fairlop Oak, of historic old trees, of things which time will sweep away and never can be replaced. Are there no old towers, no historic spots, no remarkable places, no old engravings, maps, or charters, to be represented on the walls of the Essex Museum, or was there *no old* Essex, before the Earthquake of 1884? If there *are* relics of Essex in good Queen Bess's days, let them be gathered in from the four corners of the County, to decorate Queen Elizabeth's Lodge. But—we must not talk of it—there is no room for more.

This must be our closing lament. If it is not true this year it will be next. There is no more room, not even for the bones of Boadicea, if they should be discovered at last in Dick Turpin's Cave. No room even for the Antiquities of the "Wake Arms" or a pair of Highwayman's Pistols. There is no room for a Colchester native of the time of Constantine the Great, or a pot of coins from Offa's Dyke. There is no more room—not even to speculate—there is only room left—to cry for more!

BORING IN SEARCH OF COAL IN ESSEX.

Referring to the notes on the search for coal in East Anglia in volumes viii. and ix. of the ESSEX NATURALIST, it may be well to give the full text of the Report of Messrs. Holmes and Whitaker to the Directors of the Eastern Counties' Coal Boring Association, recently prepared with a view to a further experiment. It is understood that the choice of the site for the third trial-boring is now being considered by the Directors:—

REPORT BY T. V. HOLMES, F.G.S., AND W. WHITAKER, B.A., F.R.S., F.G.S.

"The question whether one or more coal-fields underlie the surface rocks of the Eastern Counties is not yet solved, though the results already attained possess considerable value. As the Eastern Counties' Coal-Boring and Development Association is specially interested in the subterranean geology of Eastern Essex and Suffolk, it was obviously best on all grounds to begin the series of borings, by one within a few miles of that already existing at Harwich. The rocks at the bottom of the Harwich bore-hole being usually supposed to be Lower Carboniferous (though the evidence is inconclusive), it was obviously desirable to ascertain whether the Upper Carboniferous, or Coal-Measure, beds came on above them in that neighbourhood. However, both at Stutton and at Weeley rocks of similar character to those of Harwich have been found, and this fact, combined with the discovery that the dip at Stutton is southerly, and with the general resemblance of the rock at the spots just mentioned to that at Culford, near Bury St. Edmund's, makes it advisable that the next trial should be still further to the south.

"The selection of the site at Weeley was influenced by a desire to avoid the area between Colchester and Mersea, in which the damage done by the Essex earthquake was peculiarly great, as a district in which older rather than newer rocks than those at Stutton were to be expected. And the very high dip at Stutton made it possible that higher beds might come on a very short distance south of that place, and that it would be a pity to leave the area between the Stour and the Blackwater, and east of the Colne, untested. However, the similarity of the rock at all the above-mentioned places makes it seem best to suggest a site not merely south of the Blackwater, but even of the Crouch. Perhaps the neighbourhood of Rochford, Southend, and Shoebury would be as good a spot as could be mentioned. And this south-eastern corner of Essex has the advantage of being as distant as possible both from the unproductive Palæozoic rocks north of the Blackwater and of those in the district nearer London, along, and west of, a line between Crossness and Ware. The depth of the Palæozonic rocks in the tract mentioned would almost certainly be greater by 150 to 200 feet than at Weeley, owing to the greater thickness of the Tertiary rocks in South Essex, and also of the Gault. On the other hand, the Chalk is likely to be decidedly thinner.

"The Culford Palæozoic rock is apparently older than Carboniferous, probably Silurian, and lately it has been thought that the similar rock at

Harwich, Stutton, and Weeley may also be pre-Carboniferous. Another advantage of Southern Essex is that it is much nearer the Dover coal-field, which may extend in that direction, and we understand that it is proposed to put down several borings between Dover and Chatham. At the same time we are by no means disposed to under-value trial further northward, near the Norfolk and Suffolk border, as at Yarmouth.

"Any coal-fields which may occur beneath the surface rocks of Suffolk or Essex are, in all probability, small, and thrown into detached basins like those of Bristol and the Forest of Dean, or like that at Burford, on the Western border of Oxfordshire, which is certainly isolated, though its size is unknown, because, as in the Eastern Counties, the surface rocks are of much later date. Consequently only a series of borings can establish the existence and position of any coal basins under the Eastern Counties. And their probable small size and isolation evidently makes it better to bore at distances of from 10 to 20 miles apart, which would hardly allow the existence of a small coal-field like that of the Forest of Dean to remain undetected, rather than to make trials at intervals of 30 or 40 miles, which would not test any district satisfactorily."

We are pleased to say that by the kindness of Mr. G. F. Mansell, F.I.S., the Secretary to the Association, a set of specimens from the Weeley Boring (see E.N., ix., p. 254) have been sent to the Club's Museum for preservation with the set previously received from the Stutton Boring through the courtesy of Mr. William J. Graham.

DISCOVERY OF THE MALE OF PRESTWICHIA AQUATICA IN EPPING FOREST.

By FREDERICK ENOCK, F.L.S., F.E.S.

[*Read December 12th, 1896.*]

There are few Entomologists who cannot look back upon some memorable day or night spent in Epping Forest, where insect treasures are still to be found by these enthusiasts who are not daunted by repeated failures, from whom that mysterious "luck" holds aloof year after year. It is not everyone who can take a look into a basin of pond water and find over two dozen specimens, representing two species of insects, one of which *Prestwichia aquatica*, being something "quite new" to science. Yet this occurred to Sir John Lubbock in 1862[1] when he found male and female specimens of the so-called *Polynema natans*, which I have since proved to be identical with Haliday's *Caraphractus cinctus*.[2] This parasitic Hymenopteron I have taken in several ponds in Hertfordshire but not yet in Essex; although I quite expect to do so when I have carefully worked the ponds in the Forest. This elegant little fly, whose life-history is yet unknown, uses its wings for propelling itself through the water, whereas the other species—*Prestwichia aquatica*—uses its *legs* for the same purpose. The wings are kept closely pressed to the abdomen, the long cilia converging to a point over the ovipositor, which is much longer than that of *Caraphractus.* Its movements are somewhat jerky, though it manages to paddle about at a fairly rapid rate.

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[1] Lubbock, *Trans. Linn. Soc.*, vol. 24 (1863), p. 135.

[2] *Science Gossip*, N.S., vol. iii., (June, 1896), p. 13.

This strange Hymenopteron has managed to remain unrecorded for thirty-four years, and hitherto all my efforts to find it have been unsuccessful until the early part of May of the present year (1896), when I discovered a few female specimens in a pond in company with *Caraphractus.*

In response to a request which I made to the Members of the Quekett Microscopical Club, to keep a look out for these insects when "dipping," one of the members, Mr. Scourfield, kindly sent to me a female *Prestwichia* which he had taken from a pond in Epping Forest, and to which I paid several visits, capturing several females and the hitherto unknown male *Prestwichia aquatica*, which proved to be almost apterous, the wings being very rudimentary and difficult to see even when under the microscope.

In general appearance the male much resembles a very lean *flea*, both in gait and colour. Its head is ·01 of an inch broad and considerably wider than the thorax. The antennæ ·0125 of an inch long, consisting of seven joints, the same as in the female, and of a light testaceous colour. The abdomen the same width as the thorax from which it gradually tapers to a point. The legs long, and like the rest of the insect dark brown in colour. The *tarsi* are *three* jointed, with very few hairs on them or on other parts of the legs.

I am looking forward to following up these interesting aquatic parasitic Hymenoptera, whose life-histories remain unknown; this remark applies equally well to all the minute Hymenoptera, the numbers of which are so great, while the investigators of these most interesting and useful insects are yet *so* few.

THE ESSEX FIELD CLUB.

SATURDAY, MARCH 6TH, 1897.

THE 166th ORDINARY MEETING of the Club was held by kind permission of the Conductors, in the rooms of the Epping Forest Art and Science School, Knighton Villas, Buckhurst Hill, at 7 o'clock, Mr. David Howard, F.C.S., President, in the Chair.

Mr. Reuben Hunt, of Earls Colne, was elected a Member.

It was announced, on the circular calling the meeting, that the Annual Meeting would be held at the end of March, and in anticipation of it, the Council's nominations of new members of Council and Officers for 1897 were made. (See Report of Annual Meeting, page 13).

No other nominations were made, nor had the Secretary received any.

Mr. J. H. Porter gave notice of his intention to move, at the Annual Meeting, that the entrance fee at present charged, should be abolished.

The Secretary said that this would necessitate the next meeting being made Special, and it was so ordered.

The Secretary exhibited a fine head of a Buck Fallow Deer, from the famous herd at Weald Park, kindly presented to the Epping Forest Museum by Mr. C. J. H. Tower, for comparison with the race of Forest Deer. The Secretary pointed out that the Weald Park animals differed somewhat from the ordinary fallows of (for instance) Richmond Park and other deer parks. The Secretary also referred to the results of the census of the Deer in the Forest which had been made by order of the Epping Forest Committee (see "Notes.")

The President, alluding to the peculiarities of the Epping Forest Deer, said that he had been surprised to notice that the herd of Deer at Fontainbleau presented, in the dark form of the adult animals, characters similar to the forest race. He suggested that these characters were the result of long isolation and inter-breeding.

A vote of thanks to Mr. Tower for his valuable present was cordially passed.

In the absence of the Authors, Mr. W. M. Webb, F.L.S., gave an abstract of a paper on "The Post-Pliocene Non-Marine Mollusca of Essex," by Mr. A. S. Kennard and Mr. B. B. Woodward, F.L.S., F.G.S., with contributions by Mr. Webb. Mr. Webb made some supplementary remarks on the subject, and in illustration he exhibited the series of fossil shells in the Club's collections from Copford, Chignal St. James, Clacton and Ilford, and also some specimens from a deposit recently discovered at Shalford, Essex, by the Vicar, the Rev. A. J. Law. As bearing on the matter in hand, the Club's collection of recent Essex Land and Fresh-water Shells, very neatly put up in glass-topped boxes by Mr. Mothersole, the Assistant Curator, was exhibited.

Mr. Cole called attention to the important nature of the paper, as a careful summary of the knowledge at present possessed of the Post-Pliocene

Mollusca of Essex, and as giving a great number of new observations, the result of a critical examination of all known collections. He also alluded to the kindness shown by Mr. Webb in bringing up with him from Chelmsford the various specimens displayed, and also to Mr. Webb's own contributions to this interesting subject.

A vote of thanks to the authors of the paper and to Mr. Webb, was passed.

[The paper will appear in a succeeding part of the ESSEX NATURALIST.]

The second paper was an Address on "Variation in Lepidoptera," by Mr. J. W. Tutt, F.E.S., President of the City of London Entomological Society (Editor of the *Entomologists' Record and Journal of Variation*), which was read by the author. The Address treated of the following subjects:—*Origin of the colours of insects; Structure of the scales of insects; Pigmentary and non-pigmentary colours; General variation; Influence of Natural Selection in special cases; Melanism; Albinism; Colour as a secondary sexual character: Seasonal dimorphism; Spring and summer seasonal forms; Wet and dry seasonal forms of insects; Geographical races or varieties; Aberrations; bearing of variation on the origin of species.*

Mr. Tutt illustrated his remarks by several cabinet trays of specimens of variable English Lepidoptera from his own fine collection, and Mr. Cole exhibited sets of specimens illustrating the same subject, as well as dimorphism and seasonal variation.

A short discussion ensued, in which the President, Prof. R. Meldola (to whose Presidential Address to the Entomological Society in January last, on "The Utility of specific characters and Physiological Correlation" Mr. Tutt had referred) and the author, took part.

A cordial vote of thanks to Mr. Tutt for his interesting address was passed, and the meeting resolved itself into the usual Conversazione.

THE 17TH ANNUAL MEETING.

SATURDAY, MARCH 27TH, 1897.

THE 17th Annual General Meeting of the Club was held in the small hall at the Loughton Lopping Hall, at 6.30, Mr. David Howard, President, in the Chair.

The minutes of the 16th Annual Meeting held on March 28th, 1896, and printed in the ESSEX NATURALIST, vol. ix., pp. 204-206, were taken as read.

The Treasurer's Statement of Account, duly signed by the Auditors, Mr. Walter Crouch and Mr. J D. Cooper was read by Mr. Waller, together with a short report on the same (see page 17.)

The Report of the Council for the year 1896 was read by the Secretary (see page 16) as well as a short report by Mr. Durrant (who was not present) on the Library.

The Statement and Report were received and adopted.

At the meeting on March 6th last, the following members were duly proposed for ELECTION into the COUNCIL:—

Mr. J. Avery, C.A.; Mr. J. Cranmer-Byng; Mr. T. Hay Wilson; and the Rev. W. S. Lach-Szyrma, M.A.

As OFFICERS for 1897 the following were nominated:—

As *President*, Mr. David Howard, J.P., F.C.S.; *Treasurer*, Mr. W. C. Waller, M.A., F.S.A.; *Hon. Secretary and Curator*, Mr. W. Cole, F.L.S., F.E.S.; *Assistant Hon Secretary*, Mr. B. G. Cole; *Librarians*, Mr E. Durrant and Mr. W. C. Waller, M.A., F.S.A.; *Hon. Counsel*, Mr. W. C. Dare, B.A., Barrister-at-Law; *Hon Solicitor*, Mr. H. I. Coburn

As *Auditor* (*for Council*), Mr. Walter Crouch, F.Z.S.; (*For Members*), Mr. J. D. Cooper.

No other members having been proposed, the above gentlemen stood elected by Rule VII. as members of the Council and Officers for the year 1897 and were so declared by the Chairman.

On the recommendation of the Council, Mr. J. E. Greenhill was elected one of the HONORARY MEMBERS of the Club, in recognition of services rendered in connection with the establishment of the Epping Forest Museum

[The following therefore constitute the Officers and Council for 1897:

PATRON. H.R.H. the Duke of Connaught and Strathearn, K.G.

PRESIDENT. David Howard, J.P., F.C.S.

PERMANENT VICE-PRESIDENTS. (*Under Rule IV.*)—Prof. R. Meldola, F.R.S., F.R.A.S., Pres. E.S., &c. (*President* 1880-82); Prof. G. S. Boulger, F.L.S., F.G.S. (*President* 1883-84); T. V. Holmes, F.G.S., M.A.I. (*President* 1885-87); E. A. Fitch, F.L.S., F.E.S. (*President* 1888-91); Dr. Henry Laver, F.L.S., F.S.A. (*President* 1892); Frederic Chancellor, J.P., F.R.I.B.A. (*President* 1893-94).

OTHER MEMBERS OF COUNCIL. John Avery, C.A.; Rev. R. E. Bartlett, M.A.; C. E. Benham; Horace T. Brown, F.R.S.; E. N. Buxton, J.P., Aldmn. C.C., D.L., &c.; Miller Christy, F.L.S.; Walter Crouch, F.Z.S.; Bryan Corcoran; L. Cranmer-Byng; F. W. Elliott; A. J. Furbank; I. Chalkley Gould; Rev. W. C. Howell, M.A.; Andrew Johnston, Chm. C.C., J.P., &c.; Rev. W. S. Lach-Szyrma, M.A.; Alfred Lockyer; J. H. Porter; Right Hon. Lord Rayleigh, F.R.S.; J. C. Shenstone; John Spiller, F.I.C., F.C.S.; J. C. Thresh, D.Sc., M.B.; F. H. Varley, F.R.A.S.; George E. Vaughan; T. Hay Wilson

HON. TREASURER. W. C. Waller, M.A., F.S.A.

HON. SECRETARY AND CURATOR. William Cole, F.L.S., F.E.S.; ASSIST. HON. SECRETARY. B. G. Cole

HON. LIBRARIANS. Edmund Durrant and W. C. Waller.

HON. COUNSEL.—W. C. Dare, B.A., Barrister-at-Law; HON. SOLICITOR. H. I. Coburn.]

Mr. F. W. Elliott said it appeared to him that the Library of the Club at present in the rooms at Chelmsford, should be removed to the Forest district, and so located that it could be seen and used on the occasions of the Club's Winter Meetings. He thought it was high time that their Library should be rendered serviceable to the great body of the members. He therefore moved:—

"*That it is desirable that the Library of the Club should be removed from Chelmsford to the Forest District*."

This was seconded by Mr. J. C. Float (Mayor of Maldon) and carried unanimously.

Mr. Elliott then moved as a pendant to the above:—

> "*That the Council be instructed to take the matter of the removal of the Library from Chelmsford into consideration at an early date.*"

This was seconded by Mr. J. H. Porter, and carried unanimously.

The President, on behalf of the Council, then proposed:—

> "*That the cordial thanks of the Club be sent to Mr. E. N. Buxton, for his successful efforts in establishing the Epping Forest Bird Protection League.*"

The President in the course of his remarks, said that they all knew and appreciated Mr. Buxton's excellent work, as one of the Verderers, in the endeavour to restore the natural conditions of life in the forest. This late effort of his, in the establishment of the League, was just one of those enlightened acts which should receive the recognition of all lovers of Natural History. It was a matter for congratulation that the protective influence of the League was apparently already bearing fruit in the increase ot several species of birds in the district.[1]

Mr. Walter Crouch warmly supported the resolution, which was carried unanimously.

The 167th ORDINARY MEETING was then held for the election of new members. The following were duly elected:—Mrs. Laura G. Horn; Mr. Eliot Howard, J.P.; Mr. Francis Eliot Howard, and Mrs. M. E. Marsh.

The meeting was then declared a SPECIAL MEETING, in accordance with the Rules for the consideration of a proposal regarding the Entrance-fee.

Mr. J. H. Porter moved, and Mr. F. W. Elliott seconded:—

> "*That the Entrance-fee be suspended as from the* 1*st of January*, 1897, *for such time as the Council may consider necessary.*"

Mr. Porter said that practically he found that an Entrance-fee often operated as a hindrance to getting members. He gave an example from the experiences of a Society with which he was connected. His proposal, if accepted, would enable the experiment to be tried, and he hoped that a large accession of new members to the Club would be the result. He had modified his resolution so as to put the Entrance-fee into a state of suspended animation, that it might be re-imposed if the experiment was not approved of.

After a few remarks by the President, the resolution was put to the meeting, and carried.

Mr. J. D. Cooper proposed that the best thanks of the Club be given to Mr. Howard for his admirable conduct as President of the Club. Mr. Howard was almost invariably present at their meetings, and had guided the Club in a truly excellent manner in the settlement of many difficult questions.

Mr. T. Hay Wilson seconded the motion which was carried unanimously amid applause.

Mr. Howard in thanking the members for their confidence. said that anything he had been able to do was truly a labour of love. The whole sphere of the operations of the Club was in his opinion highly interesting and valuable as an educational agency. The Field Meetings were most enjoyable and the work of the Club deserved the support of all intelligent persons. Any service to the Club within his power would be most cheerfully rendered. (Applause).

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[1] See short analysis of the first Report of the League printed in the present part of the E.N.

Mr. John Spiller in an appreciative speech, proposed a cordial vote of thanks to the Officers of the Club, including the Auditors, Messrs. Crouch and Cooper. Mr. Spiller particularly referred to the important services which Mr. Waller had rendered the Club as Treasurer.

The President also referred to the work of Mr. Waller as being of great value to the Club.

The vote of thanks to the Officers was carried unanimously.

Mr. W. Cole replied for the Hon. Secretaries, and Mr. Crouch for the Auditors, Mr. Waller having to leave the meeting before the vote came on.

Mr. Howard then delivered his ANNUAL PRESIDENTIAL ADDRESS, which was mainly devoted to the consideration of "Field Work as Science Training" and during which he gave some very interesting reminiscences of the condition of Epping Forest in his young days. [Mr. Howard's Address will be printed in the next number of the ESSEX NATURALIST.]

On the proposal of Mr. Crouch, seconded by Mr. W. Cole, a vote of thanks was passed to the President for his address, and the Meeting ended, tea and coffee being served as usual afterwards.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31ST, 1896.

[Read and adopted at the 17th Annual Meeting held at Loughton, March 27th, 1897.]

FINANCIAL.—The general income of the Club shows an increase of £73 as compared with the previous year—a result largely due to the action taken by the Sub-Committee of the Council which was appointed to deal with subscriptions in arrears, and to which allusion was made in the last Annual Report. This increase in receipts was unfortuately accompanied by a corresponding rise in the expenditure, and no material reduction in the adverse balance brought forward has been effected. It should, however, be added that, in addition to certain old liabilities, all those contracted during the year are, with insignificant exceptions, included in the year's accounts, in accordance with the special instructions of the Council. So that the Club started the year 1897 with a fair prospect that the hopes expressed last year may find a partial fulfilment in this.

The debit balance on the Publications Account has been further reduced and now stands at something over £24; but, on the other hand, the Museum Accounts are now both overdrawn. The expenses of the Central Museum have, since the close of the year, been very considerably reduced, and it is hoped that before long an arrangement may be made whereby they will be to a large extent otherwise provided for.

Although the Life Composition Account is represented by valuable assets, the Council, deeming it desirable that it should be represented by an invested

TREASURER'S STATEMENT OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31ST DECEMBER, 1896.

GENERAL ACCOUNT.

DR.

	£ s. d.	£ s. d.
To Subscriptions, [illegible]-92	15 0 0	
„ „ 1893	8 [illegible] 0	
„ „ 1894	16 10 0	
„ „ 1895	47 10 6	
„ „ 1896	140 2 6	
„ „ 1897	4 10 0	
	238 15 6	
Less received in error and refunded	1 5 6	
		237 10 0
„ Entrance Fees		5 15 0
„ Sale of Museum Guides		1 18 11
„ Subscriptions to Forest Museum [Maintenance]		[illegible] 2 6
„ Crossed Cheques Returned		9
„ Balance [Excess of Payments over Receipts]		72 7 5
		£326 14 7

CR.

	£ s. d.	£ s. d.
By Balance from 1895 [Excess of Payments over Receipts]		73 16 2
„ Printing and illustrating "Essex Naturalist" [2 parts]		99 8 8
„ General Printing and Stationery		30 12 10
„ Postage of "Essex Naturalist" and Circulars, Officers' Correspondence, &c.		25 9 6
„ Incidental Expenses		19 11 6
„ Central Museum—		
Rent of Building	25 0 0	
„ Cottage [five quarters]	7 6 3	
Railway Expenses of the Hon. Curator [six months]	9 18 0	
Salary of Sub-Curator [Mr. Mothersole]	13 0 0	
		55 4 3
„ Fire Insurance		2 13 6
„ Library Expenses, Books, Binding, &c.		8 12 11
„ Lecturers' Fees		5 15 6
„ Hire of Meeting Rooms, &c.		4 17 10
„ Loss on Field Meetings		11 11
		£326 14 7

SPECIAL MEMOIRS AND PUBLICATION ACCOUNT.

	£ s. d.
To Sale of Publications ["Essex Naturalist"]	8 13 7
„ Balance [Excess of Payments over Receipts]	24 18 9
	£33 12 4

	£ s. d.
By Balance from 1895 [Excess of Payments over Receipts]	33 12 4
	£33 12 4

CENTRAL MUSEUM FUND.

	£ s. d.
To Balance from 1895	6 0 8
„ Donation [illegible]	1 10 0
„ Balance [Excess of Payments over Receipts]	9 13 2
	£17 3 10

	£ s. d.
By Red Crag Fossil Collection	2 0 0
„ Half Cost of First Instalment on Type-writer	3 12 6
„ Fittings, Chemicals, &c.	11 11 4
	£17 3 10

FOREST MUSEUM FUND.

	£ s. d.
To [illegible]	7 14 7
„ [illegible]	17 14 6
„ Balance [Excess of Payments over Receipts]	5 7 0
	£30 16 1

	£ s. d.
By Printing, Circulars, &c.	8 2 6
„ Half Cost of First Instalment on Type-writer	3 12 6
„ Specimens	2 11 6
„ Sundry Fittings	16 9 7
	£30 16 1

LIFE COMPOSITION ACCOUNT.

	£ s. d.
To [illegible]	115 0 6
	£115 0 6

	£ s. d.
By Cash at Bankers, Dec. 31st, 1896	2 11 5
„ „ in hands of Hon. Secretary	2 9
„ General Account	72 7 5
„ Publication Account	24 18 9
„ Central Museum	9 13 2
„ Forest Museum	5 7 0
	£115 0 6

[illegible] in books, specimens, cabinets, stock of publications, etc., which although valuable cannot easily be [illegible].

Examined with the Vouchers this 22nd day of March, 1897, and found correct,

WALTER CROUCH, } *Hon. Auditors.*
JOHN D. COOPER, }

fund, has recently resolved upon such measures as will, in course of time, bring about that result.

MEETINGS.—Nine Ordinary and Field Meetings have been held, the proceedings at which quite upheld the reputation acquired by the Club. The Council regret that the meeting-places have not been more widely spread over the County, and they would earnestly ask for the co-operation of members living in Essex to endeavour to extend the range of our meetings during the coming season. Some dredging excursions off the coast have several times been suggested, but such meetings are costly, and unless a large body of members would promise to support them, the Council could hardly venture to incur the financial risk of hiring a vessel or steamer suitable for the work. If a general desire were expressed for holding such a meeting during the summer, the Council would be glad to arrange one.

Early last year, in order to encourage work in the open, the Council initiated a few Field Demonstration Meetings, and Mr. Paulson, Mr. E. M. Holmes, and Mr. Marquand very efficiently conducted them. It is intended to continue the plan, and to extend the subjects of the demonstrations.

In connection with the meetings of the year, the Council have again to thank Major Lamorock Flower for his kind assistance at the voyage on the Lea on June 27th, and also the Lea Conservancy for the loan of the steam barge on that occasion. They have also to thank Mr. E. M. Holmes, Mr. Marquand, Mr. W. M. Webb, Mr. E. N. Buxton, Prof. Boulger, Dr. Cooke, Mr. A. Lister, Miss G. Lister and others, for most valuable aid rendered at various meetings, full details of which are recorded in the reports in the ESSEX NATURALIST.

PUBLICATIONS.—Two parts of the ESSEX NATURALIST were published in 1896 comprising Nos. 7-22 of Vol. ix., and extending (with Title and Index to Vol. viii.) to 192 pages. To this must be added the 20 pages of the List of Members and List of Transactions and Periodicals in the Library, making 212 pages in all. The Council have to thank Mr. T. V. Holmes for a donation of £3 5s., being half the cost of the Map illustrating the Physical Geography of Essex, and Mr. H. A. Cole for 10 original drawings illustrating the reports of the Field Meetings. Many of the papers contributed are of considerable interest and value, and our Journal still maintains its high character as a *local* publication. In order to reduce cost and to render the volumes of the Journal more uniform in size, it has been determined to make the volumes biennial in future, and accordingly Vol. ix. includes papers and reports for 1895 and 1896. The last part of Vol. ix., with Title and Index, was published in January, 1897, thus bringing the Journal absolutely up to date.

The Council begs to call the serious attention of the members to the Editor's repeated requests for aid in the way of short notes and papers. It is felt that with the membership of the Club, including many, actively engaged in natural history pursuits, more contributions might be looked for; Essex affords an admirable field for observation, and it is greatly to be wished that more members would engage in the task of observing and cataloguing, so as to enable us to ascertain the extent of the natural riches of the County and at the same time to improve our Journal.

COUNTY MUSEUM.—The position of the Club's County Natural History Museum, at Chelmsford, has long been a matter of very great anxiety to the

Council. The hope of financial support from Chelmsford and its neighbourhood, upon the expectation of which the settlement of our Museum in that town, and the amalgamation of the old Chelmsford Museum Society with the Club were based, has hitherto proved to be wholly fallacious. The Club has raised a fund of about £150, the whole of which sum has been expended upon the Museum, and the annual cost of rent, Sub-Curator's salary, &c., on the average of the three years ending 1895 was about £60, and this without making any allowance for the Hon. Curator's railway fares, which, if paid, would amount to £20 more. It is quite obvious that the Club cannot bear such a drain upon its resources without very considerable compensating advantages, and the Council has long since come to the conclusion, as stated in Mr. Howard's Presidential Address last year, that the position of affairs required very careful consideration. Without further considerable expenditure it will be impossible to open the Museum to the public. In September last a small Committee was formed at Chelmsford for the purpose of raising a sum of at least £50 in order to enable the Council to open the Museum. Unfortunately this Committee failed to attain its objects, and it has since been dissolved. The earnest attention of the officers and several other members of the Council having been given to this important matter, at last, at a meeting on March 2nd, the following resolutions were submitted to, and were unanimously passed, by the Council at a numerously attended meeting:—

ESSEX COUNTY NATURAL HISTORY MUSEUM.

Resolutions passed at a Meeting of the Council of the Essex Field Club on March 2nd, 1897.

(1.) That this Club do negotiate with the Corporation of Chelmsford for carrying on the County Natural History Museum, at Chelmsford, generally upon the following scheme, subject to any alterations which may be considered desirable:—

(2). The Essex Field Club is unable to maintain its County Natural History Museum unless it receives Financial assistance from outside bodies or from one or other of the public bodies of the County.

(3.) The following conditions are necessary for the maintenance of the Museum:—

(*a.*) That the "Public Body" will provide a suitable building or set of rooms for the Museum, rent free, and will also provide for the caretaking, warming, and lighting of the Museum. And that the "Public Body" will also make a grant towards the Curating of the Museum.

(*b.*)—The Essex Field Club will undertake the scientific management of the Collections.

The Club will do its utmost to add to the collections and to raise a Fund for the purchase of museum appliances, specimens, &c.

That portion of the collections contributed by the Essex Field Club to remain the property of the Club; that portion contributed by the "Public Body" to remain the property of that body

In the event of the Club dissolving, the collections and cabinets in the Museum belonging to the Club to become the property of the "Public Body."

(4.) That the above offer be first made to the Chelmsford Corporation, but in the event of their refusing the same, or failing to come to an arrangement with the Club within three months after the date of the offer, then that the offer be extended to other Public Bodies in the County.

The above resolutions were sent to Mr. Chancellor as Mayor, on March 4th, 1897, and have, the Council understands, been brought before a Meeting of the Town Council of Chelmsford, and their decision is now awaited.

The Council are fully aware that the above offer can only be considered a tentative one—any final settlement of the matter must rest with the whole Club at a Special Meeting called for the purpose.

So much depends upon the decision of the Town Council of Chelmsford, even with regard to the location of the Museum, that it will be best to defer any extended report on the work in it until this vital question has been decided. Work has been carried on steadily during the year so far as time and funds would allow. Mr. Smoothy's loan Collection of Birds has been removed by him, at his own suggestion, inasmuch as they were not local, and the Curator had no power to arrange the specimens with the other collections in regular order. The other birds in our possession have all been mounted on stands, and labelled and arranged in the wall cases. The greater part of the collection of Birds' Eggs has also been arranged species by species in glass-topped boxes; the Club's collection of Land and Fresh-water Shells has been put up in boxes by Mr. Mothersole most skilfully, and the valuable series of Pleistocene Mollusca has been determined and arranged by Mr. W. M. Webb. The collections illustrating the Red Hills, the Denehole Explorations, and the collection of Flint Implements have also been arranged. As also the collection of Bats and Reptilia. A beginning has been made with the Insects, Crustacea, and other classes of Invertebrata, as well as with the very large collection of Red Crag Fossils. The Club has purchased a small collection of Red Crag Fossils from Walton-on-Naze, from Mr. Brown, formerly of that place, to the cost of which Mr. Round, Mr. Shenstone, and Mr. Howard kindly contributed.

But the Curator's work is now much hindered by the want of funds, both capital and income, and it would be unreasonable to expect that much progress can be made until these are provided.

Mr. G. P. Hope has added to his former valuable donations a very fine case of Birds; the specimens are not from Essex, but they have been accepted to represent several rare species until Essex specimens can be obtained. A donation of about 30 species of local Birds' Eggs has been received from Mr. F. Brown, of Chelmsford, and Mr. Crick has presented three mounted specimens of Essex Birds.

In connection with presentations to the Museum of the Club, the Council wish to emphasize the conditions under which above specimens and collections can be received. These conditions, which are in strict accordance with the Rules, are set out in the letter of acceptance which is sent to each donor as follows :—

"CONDITIONS AS TO ACCEPTANCE OF DONATIONS TO THE ESSEX FIELD CLUB MUSEUMS.

"The Council and Director will take every possible care of accepted specimens and collections, and will make due acknowledgment of the kindness of the donors, but they reserve to themselves the power of exhibiting or storing them in cabinets or otherwise, in ways most useful for the purposes of the Museum; to place them in any Branch Museum belonging to the Club; and to exhibit them on loan in any part of the County of Essex. They also reserve right to remount or re-arrange the specimens or collections; to incorporate them with other collections, and to dispose of duplicates by exchange or otherwise as may be thought best in the interests of the institution considered as a Local and Educational Museum."

The Council wish to point out the absolute necessity of such stipulations being laid down and of liberty to deal with collections and specimens being given to the Curator, if the Club and he are to be held responsible for the scientific arrangement of its Museums, so as to avoid the errors and dangers so commonly observed in the curating of old so-called "Local Museums." And it is of the greatest importance that these rules should be at once clearly and firmly laid down, now that the Club is asking for the co-operation of out-side bodies in the carrying on of the Museums

THE EPPING FOREST MUSEUM.—The remarks given above with regard to deferring a full report equally apply to the Forest Museum. Several very important questions in connection with it still are unsettled, and as future plans so much depend upon these questions, any definite statement of policy with regard to the future of the Museum must of necessity come later.

The success of the idea, and the interest shown in the Museum is clearly proved by the attendance. Quite 10,000 people have visited the Museum since its opening on November 4th, 1895. And a large number of schools, both public and private, have met in the Museum. Among the scientific bodies that have held meetings there, we may mention the British Archæological Association, the Geologists' Association, the Selborne Society, the Toynbee Hall Natural History Society, the City of London Entomological Society, the North London Natural History Society and several others. The Epping Forest Committee have visited it on several occasions, and have expressed their approval. Notwithstanding the large number of visitors of all classes, not a single specimen or case has been injured, although the Museum has been open every day, including all the Bank Holidays.

The Hon. Curator has on many occasions, at the request of the principals of Schools and Secretaries of Societies, given short demonstrations of the various collections in the Museum; and Mr. Chalkley Gould has also given his services in this way. The Council suggest that gentlemen specially acquainted with the several subjects exhibited might render excellent service in this way—"Afternoons at the Museum" might thus be made very instructive to the visitors.

A few new collections have been put into the Museum by the Hon. Curator, including a collection of the Bats of the Forest, a series illustrating the manufacture of Gun-flints; a collection showing the transformations of the Lepidoptera, &c. The Curator is now preparing a series showing the classification of Insects, and one to demonstrate the biology of Oak and other Galls. These will be put into the Museum in the early Summer.

Mr. Greenhill has parted with his magnificent collection of Palæolithic Implements, and it has consequently been removed from the Museum, but he has kindly left on loan a very interesting series of duplicate specimens, and many neolithic implements, &c. With the aid of these, the Club's specimens, specimens lent by Mr. Crouch, the Rev. Mr. Kenworthy and himself, the Curator has been enabled to make up a very fair collection of Stone Implements illustrating their form, mode of occurrence, and method of manufacture.

To render possible the preparation of labels and descriptive tables in our Museums, the Council has purchased, on very advantageous terms, an excellent Typewriter from the Hammond Company, which has been, and will be, of the greatest service.

The donations to the Museum have not been numerous. Prof. Meldola has presented Dr. Cooke's valuable work on Fresh-water Algæ, and two vols. of Dr. Braithwaite's Monograph of the Mosses; Mr. Holmes has presented a geological map; Mr. Tomlin, two wasp nests found at Chingford; Mr. Wattson, specimens of Neuroptera; and Mr. Tower, a fine head of a Fallow Buck from Weald Park. Several other donations have been received, and a full list will be given when a more extended report is presented.

The experience of the winter of 1895-6, proved to the Curator the necessity of having some means of lighting up the Museum on dark afternoons, and the experience of this last Winter, 1896-7, has still more strongly emphasized the necessity of providing some efficient means of keeping the Museum *Warm* and *Dry*. If the Museum is to be a complete success as an educational exhibition more space is also imperatively necessary. All these matters are being anxiously considered, and it is hoped that our applications to the Epping Forest Committee will be granted, and that the Museum will be placed on a satisfactory footing both with regard to space and warming. The Council hardly feel at liberty to make a more definite report while the negotiations are pending, but probably in a few months time they may be able to make a satisfactory statement.

THE LIBRARY.—With reference to the principal portion of the Club's Library which is, under Rule 24, located at the Central Museum, the Hon. Librarian there reports that during the past year sundry copies of the *Transactions* of other Societies have been received by way of exchange, and that the ESSEX NATURALIST has been sent in return to them and to others on the exchange list. A list of the various periodical publications in the Library has been prepared and printed, and was issued to members with a recent number of the E. N. The Library has been closed during the past year, but arrangements have now for some time been made by which bound volumes can be borrowed by members, on applying by letter to the Hon. Librarian, Central Museum, Chelmsford, and paying the costs of carriage.

As touching the remaining portion of the Library, which is located in the Forest Museum at Chingford, the Hon. Librarian there reports that during

1896 the Barclay-Johnston Collection of MSS. and Papers has been sorted, arranged, and calendared, as already detailed in the ESSEX NATURALIST, vol. xi., pp. 157 *et. seq.*; and that the miscellaneous books have been arranged and catalogued, a duplicate list of them being sent to the Central Library for incorporation in the Catalogue there. A Register of books lent out has also been provided. The collection includes a set of the Club's Periodical Publications and Special Memoirs, recently bound up expressly for the use at the Forest Museum; and a similar set will shortly be placed in the Club's Library at Chelmsford.

EPPING FOREST BIRD PROTECTION LEAGUE.--The establishment of this League was referred to in a recent number of the ESSEX NATURALIST. The first report has been issued by Mr. Buxton, and shows that the scheme is working well, and that a marked increase in several species of birds has been observed in the districts protected by the mutual agreements of the members of the League. The Council think that Mr. Buxton should be warmly thanked by all Field Naturalists for his efforts in the protection of the birds of the Forest district, and beg to suggest that a special vote of thanks to Mr. Buxton should be passed at the Annual Meeting.

The Council have great pleasure in again recommending Mr. Howard for election as President for the coming Session.

PRACTICAL HINTS ON THE STUDY OF THE MYCETOZOA, WITH NOTES ON THE EPPING FOREST SPECIES.

BEING THE SUBSTANCE OF AN ADDRESS DELIVERED AT THE ANNUAL "FUNGUS MEETING" ON NOVEMBER 21st, 1896.

By ARTHUR LISTER, J.P., F.L.S.

I WILLINGLY avail myself of the offer of the editor to find room in the ESSEX NATURALIST, for a notice of the Mycetozoa collected on November 21st, on the occasion of the annual "Fungus Foray" in Epping Forest.

It is the first time that the Essex Field Club has made the search for these organisms a special part of the day's programme, and I hope that it will be followed by a systematic endeavour to encourage the study of the group by members of the club, though we must not forget that Dr. Cooke recommended the pursuit at one of our meetings several years ago.

The search was made on this occasion almost exclusively for the forms inhabiting the dead leaves under the hollies which abound in the attractive part of the Forest near "Cook's Folly."

The leaves under these old trees have been rich in a variety of species which have appeared during the wet weather that prevailed through the months of September and October. Although the time at our disposal was limited, 13 species were collected, viz.: *Badhamia rubiginosa*, *Physarum diderma*, *P. vernum*, *Craterium pedunculatum*, *Leocarpus vernicosus*, *Chondrioderma radiatum*, *Didymium effusum*, *D. nigripes*, *D. clavus*, *Comatricha persoonii*, *C. rubens*, *Lamproderma irideum and Arcyria albida.*

Some of the specimens deserve notice as of considerable interest. *Badhamia rubiginosa* was found in abundance under one of the hollies, and this is the first time that it has been recorded in the Forest district. *Comatricha rubens*, an elegant species only lately added to the list of Mycetozoa, was also discovered. *Physarum diderma*, may often be overlooked from its similarity to the more frequent *P. bivalve*. *Chondrioderma radiatum*, which more often inhabits fir woods, was gathered on the dead leaves. *Physarum vernum* was collected and named by Sommerfelt in 1827, but has only recently been recognized as a British species; a full description will, I hope, shortly appear in the *Journal of Botany*. Sommerfelt's original gathering is in the Christiana Museum, Norway.

In the evening the spoils of the ramble, consisting of Fungi and Mycetozoa, were displayed on tables at the Royal Forest Hotel, Chingford, and at the same time the "streaming" plasmodium of *Badhamia utricularis* was exhibited under the microscope, when the rhythmic flow of protoplasmic matter was seen passing through a network of veins. This streaming of the plasmodium in the Mycetozoa is the most remarkable instance of the movement of naked protoplasm on a large scale that is met with in Nature. A series of drawings representing the sporangia of different species belonging to several genera of Mycetozoa were arranged on a screen, and some explanation was given of the various and beautiful structures by means of which the minute spores are lifted from the sporangia, or so disposed that they may be carried away by the winds. The germination of the spores was then touched upon, and the manner in which the contents of the spore emerge as an amoeboid body, or "swarm-cell," which swims in the surrounding water with a dancing movement caused by the lashing of a long flagellum. The feeding by the swarm-cells on Bacteria, and their multiplication by bi-partition was referred to, and their subsequent coalescence to form the plasmodium such as was to be seen under the microscope on the table. A short account followed of the manner in which the plasmodium ultimately assumes the form of the sporangia, which resulted in the production of the innumerable spores, thus completing the cycle of changes through which the organism passes.

If any of your readers wish for a fuller account than your space will admit, I may add that the Trustees of the British Museum have issued a *Guide to the British Mycetozoa exhibited in the Department of Botany* (price 3d.) which gives in the introduction a more detailed sketch of this remarkable life-history with illustrations.[1]

For those who are disposed to take up the study of these beautiful organisms, I offer, at your suggestion, Mr. Editor, a few directions regarding their collection and preservation.

In the first place it must be borne in mind that although Mycetozoa abound in the Forest they are for the most part minute and fragile, and require patient and careful searching for, and, further, that their investigation can only be conducted by the aid of a good, though not necessarily expensive microscope. (Messrs. R. & J. Beck, 68 Cornhill, supply as cheap and efficient an instrument as any maker I know.) A 2-inch objective is a convenient power for gaining a general idea of the object, and $\frac{1}{8}$ inch objective is necessary for examining the minute detail; these two powers are sufficient for the determination of species, but for thorough investigation a $\frac{1}{10}$th in. water immersion, or a Zeiss's $\frac{1}{15}$th in. is often useful.

In collecting, we use a square basket with a lid; into this leaves may be placed one over another without fear of injury (as the curved surfaces of holly and most other leaves protect the sporangia from being crushed), while you have plenty of room to pack away sticks and rotten wood on which many species are found. When the sporangia are not mature, be careful to surround them with plenty of damp leaves, and on reaching home lay the unripe specimens on a wet plate under a bell jar for 24 hours, or longer if necessary. Many rare forms in our public herbaria have been rendered almost worthless by being allowed to dry before reaching maturity. It may prevent waste of time for the searcher to remember that the species growing on leaves are generally found on the *upper layer* of those that are wet and rotten, among which the plasmodium has been feeding; it creeps through the lower layer to the dryer parts to form into sporangia, but seldom reaches the lately fallen superficial leaves.

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[1] Students should also consult Mr. Lister's larger *Monograph of the Mycetozoa*, with 78 plates and 51 woodcuts (price 15s.) also published by the Museum authorities, and obtainable at Cromwell Road.—ED.

In permanently storing the specimens, after cutting off the superfluous part of the leaf or dead wood, glue the object on to a card tray with the two ends turned up at right angles, so that it will loosely fit into a match box, or better still, a paste-board box with a free lid. Such boxes are sold by Messrs. Maw, Aldersgate Street, London, for about 1s. 6d. a gross. The turned up ends of the tray protect the specimen when taken out of the box if it should happen to fall.

In preparing a sporangium for examination on a glass slide, first supply a drop of strong methylated spirit to expel the air from among the spores; then add water and carefully wash out the spores from among the capillitium with the aid of a couple of mounted needles. As this requires some delicacy of treatment, it should be done under a watchmaker's glass mounted on some simple stand. Then lay on a thin cover glass, and the object is ready for the microscope.

If the specimen is to be preserved, mount in Glycerine-jelly. My own practice is, after draining off the water and superfluous spores, to add a drop of 1 to 20 solution of Carbolic Acid. Let this also be drained off, and with a knitting needle, place on the object a drop of Glycerine-jelly, melted by immersing the bottle containing it, in hot (*not boiling)* water. Lay the glass slide on a flat bottle filled with hot water, you can then at your leisure arrange the sporangia and capillitium before putting on the thin cover. This should be done under the watchmaker's glass, and care must be taken to avoid including bubbles of air. These air bubbles under the cover glass give trouble at first, but you soon learn to avoid them with the hot plate. When the preparation is cold, carefully wash off the jelly round the edges of the thin cover glass and wipe dry; then ring with Hollis's Glue, and after a few hours paint over the glue with Gold Size. Specimens prepared in this manner will last in perfect condition for very many years. Canada Balsam in Xylol is a much simpler medium to use and is the best for mounting sporangia of the genus *Cribraria*; but in species in which the markings on the spores are an important character, glycerine-jelly is essential, as in balsam the spores shrink.

I would strongly advise any one who takes up the study of the Mycetozoa to record in a note book the date and circumstances of each gathering, with a drawing, if only in outline, of the appearance under the microscope, with both low and high powers. If possible, use a Camera Lucida; you will then have your drawing made to scale, and the spores can at any time be accurately measured.

In conclusion, it will always give me pleasure to name specimens or give any help I can to members of the Essex Field Club who may wish to work at the group.

THE NON-MARINE MOLLUSCS OF ESSEX.

By WILFRED MARK WEBB, F.L.S., Editor of the *Journal of Malacology*.

[*Read June 27th, 1896.*]

UP to the present time, so far as the writer's knowledge goes, no general catalogue of the land and freshwater mollusca of Essex, dealing with that county as a whole, has been made out.

Several important local lists from smaller districts are, however, to be found, chiefly in the publications of our Essex Field Club. These, together with the notes and collections which friends and correspondents have kindly put at the service of the writer, and the specimens preserved in various museums, have furnished the bulk of the material out of which the present paper has been built up.

The following is a detailed list of authorities:—

A LIST OF AUTHORITIES FOR LOCALITIES AND OF COLLECTIONS IN WHICH SPECIMENS ARE PRESERVED.

Adams, Lionel E.—A manuscript list of shells taken in 1881 and 1890, chiefly in the neighbourhood of Halstead, Coggeshall and Colchester.

Bailey, George.—A manuscript list of shells from Finchingfield.

British Museum, Natural History.—(1.) A series of shells, chiefly from Coggeshall, purchased in 1847 from Mr. Hall.§

British Museum, Natural History.—(2.) *Collections of Pleistocene Mollusca from:—Braintree; Clacton; Copford (John Brown Collection); Grays; Kelvedon; Rayne; Roxwell* (see Christy, Reginald); *Walthamstow (Joseph Wood Collection); Walton; West Thurrock* (see Woodward); *Witham.*

Brown, John.—(1.) "*Shell Marl at Copford,*" *Journ. Geol. Soc.*, vol. viii. (*August*, 1852), *see also* "*Chelmsford Chronicle,*" *September 22nd*, 1843. *For corrected list, see specimens in British Museum.*

§ For a note on Mr. Hall see E.N., vol. iv., p. 226.

Brown, John—(2) *A list of shells collected near Walton (really at Clacton) and presented to the Chelmsford Museum in "Geology of the Walton Coast," Essex Herald, Tuesday, August 1st,* 1843. *For corrected list, see* Webb (4).

Christy, Miller.—(1.) A collection of land and freshwater shells, containing many species from Essex.

Christy, Miller.—(2.) "*Notes on an Alluvial Deposit in the Cann Valley, with a list of Mollusca occurring therein.*" Essex Naturalist, vol. iii. (1889), p. 1.

(3.) *A collection illustrating the above list, corrected in the Essex Field Club*'s *County Museum,*

Christy, Reginald.—"*Notes on the Geology of the District around Chelmsford, with a list of the Mollusca from the Alluvium at Roxwell, Essex.*" (*The shells were determined by* B. B. Woodward.) Essex Naturalist, vol. iii (1889), p. 171.

Cole, William—New records.

Conchological Society.—" Authenticated Records of Essex Land and Freshwater Mollusca" (by William Denison Roebuck), in manuscript.

Crouch, Walter.—" On the Land and Freshwater Mollusca of the Beacontree Hundred, Essex." Essex Naturalist, vol. iv. (1890), p. 202.

A collection illustrating the above paper is exhibited in the Club's Epping Forest Museum, Chingford.

Essex Field Club County Museum—A collections of shells from near Colchester (Laver Collection). Specimens from Coggeshall and various localities.

Essex Field Club County Museum.—*Collections of Pleistocene shells from Chelmsford* (Webb *Collection*) ; *Chignal* (Christy *Collection*) ; *Clacton* (John Brown *Collection*).

Essex Naturalist.—Notes on Mollusca. The reference is given in each case.

French, J.—(1.) " Preliminary List of the Land and Freshwater Mollusca occurring in the neighbourhood of Felstead, Essex." Essex Naturalist, vol. ii. (1888), pp. 1-3.

Additions and Corrections, pp. 46 and 47.

French, J.—(2.) "*On the Mollusca of the Shell Marl occurring at Felstead and in other parts of Essex.*" Essex Naturalist, vol. iii. (1889), pp. 11-15.

Horsley, J W.—A manuscript note on some Thames Estuary Mollusca.

Hughes, Frank.—A note-book chiefly on Bishop's Stortford Shells (see Ingold, with whom he worked).

Ingold, E. G.—" List of Land and Freshwater Mollusca of the neighbourhood of Bishop's Stortford." Essex Naturalist, vol. iv. (1890), pp. 215-217.

Additions and Corrections, vol. v. (1891), p. 202.

Jenkins, A. J.—" Notes on the Mollusca of the Thames Estuary, with a List of Species observed." Essex Naturalist, vol. v. (1891), pp. 220-232.

Kennard, A. S., and Woodward, B. B.—*New Records for Post-pliocene Shells.* See the note below.

King, William Doubleday.—" List of Land and Freshwater Shells of Sudbury." *Zoölogist*, vol. xi. (1853), pp. 39-43.

Laver, Henry.—" On the Land and Freshwater Mollusca of the District around Colchester." *Trans. Essex Field Club*, vol. ii. part 6 (1882), pp. 88-97.

A collection illustrating the above in the Club's County Museum.

Newstead, A. H. L.—A manuscript list of shells found in the neighbourhood of Epping.

Saffron Walden Museum.—A collection of Essex shells; manuscript list by G. E. Maynard, Curator.

Sheppard, Revett.—(1.) "Descriptions of seven new British Land and Fresh-water Shells, with observations on many other Species, including a list of such as have been found in the County of Suffolk" (and occasional notices of Essex localities, Tendring Hundred). Read March 4th, 1823 *Trans. Linn. Soc. Lond.*, vol. xiv. (1825), p. 148.

(2.) A collection containing many Essex specimens in the possession of Philip B. Mason, of Burton-on-Trent, who kindly furnished a manuscript list.

Smith, Edgar A.—"Note on *Hydrobia jenkinsi*." Essex Naturalist, vol. iv (1890), pp. 212-214, Fig.

Turner, Edwin.—A manuscript list of shells from Coggeshall and Witham.

Webb, Wilfred Mark.—(1.) New records.

(2.) On the manner of feeding in *Testacella scutulum*, Sowerby. *Zoölogist*, vol. xvii. (1893), pp. 281-9, pl. i. Review in Essex Naturalist, vol. vii. (1893), pp. 120-3, Figs.

(3.) Worm-eating Slugs. *Testacella haliotidea* at Widford. *Journal of the Essex Technical Laboratories*, vol. ii., p. 127. At Stisted, p. 242.

(4.) "*Museum Notes, I. Pleistocene Non-marine Mollusca from Walton-on-the-Naze.*" Essex Naturalist, vol. viii. (1894), pp. 160-162. [*The shells are described as from near Walton, and there is now no doubt but that they came from* Clacton, *as suggested by* A. S. Kennard.[§]—W. M. W.] *See* Brown.

(5.) "*Note on the shells from the Brickearth at Chelmsford.*" Essex Naturalist, vol. ix. (1895), pp. 19-20.

Woodward, B. B.—"*On the Pleistocene Non-marine Mollusca of the London District,*" *Proc. Geol. Assoc.*, vol. xi., pp. 335-388. *Contains revised lists of Pleistocene shells, now for the most part in the British Museum.*

Note.—Through the kindness of Messrs. A. S. Kennard and B. B. Woodward, whose paper on the *Post-pliocene Non-Marine Mollusca of Essex* was read at the Meeting of the Essex Field Club on March 6th, 1897, a number of new records for fossil shells have been included in the present paper. These are not marked with a dagger (†)

Essex is, generally speaking, a well-defined district, and the county has been divided by Professor Boulger[‖] into three provinces, and these again into seven sub-provinces, according to the river-valleys. This seems, however, to be going into too great detail for the present purpose, so Professor Boulger's sub-provinces I., II., and III. (Lea, Roding, and Crouch) will be taken together as A, or South and West Essex; IV. and V. (Blackwater and Colne) as B, or Central Essex; VII. and VIII. (Stour and Brook) as C, or North Essex. Of these, Brook, or Saffron

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[§] *Science Gossip*, vol. iii., N.S., (1896), p. 119.

[‖] *Trans. Essex Field Club*, vol. ii. (1882), pp. 79-87 (with map), and vol. iv., pp. 131-134.

Walden district, belongs in reality to the river system of Cambridgeshire. Localities for the species are given under these three headings, and are followed in all cases by the name or initials of the authority for them, or of the museum in which the specimens are preserved.

LIST OF THE NON-MARINE MOLLUSCS OF ESSEX.

DISTRIBUTION.

A. South and West Essex; valleys of the rivers Lea, Roding, and Crouch.

B. Central Essex; valleys of the rivers Blackwater (Chelmer) and Colne.

C. North Essex; valleys of the rivers Stour and Brook.

CLASSIFICATION.

The general classification is according to Lang's *Text-book of Comparative Anatomy*, English edition, part ii. (1896); the families are those given by Fischer in his *Manuel de Conchyliologie*, and the generic names adopted by Pilsbry in his *Guide to the Study of the Helices* have been used; while in order that the species which do not occur in the county may be noted, all the British species have been given.

SIGNS AND ABBREVIATIONS.

If the name of a species be placed within square brackets, it signifies that the form has hitherto been found in Essex only in a fossil state; if, further, the name be in lighter type, the species is not known to occur in the county.

An asterisk (*) *denotes that specimens are in the possession of the Essex Field Club; a dagger* (†) *signifies an addition to, a double dagger* (‡) *a correction in, a published list.*

Records for fossils are printed in italics. Fossils that have not been recorded by B. B. Woodward, or which have not been determined by him, A. S. Kennard, or the writer, are placed within square brackets.

C.S.R.	Conchological Society's *Authenticated Records.*
E.N.	ESSEX NATURALIST.
K. and W. ...	Kennard and Woodward.
S.W. Museum ...	Saffron Walden Museum.
W.M.W. ...	The Writer.

Class—GASTROPODA.

Order—PULMONATA.

Sub-order I.— STYLOMATOPHORA.

(A) *MONOGONOPORA.*

Family—TESTACELLIDAE.

Genus—TESTACELLA, Cuvier, 1800.

[*Testacella maugei*, Férussac.]

Testacella haliotidea, Draparnaud.
B.—Stisted ; *Widford ; (Webb, 3).

Testacella scutulum, Sowerby.
A.—Buckhurst Hill ; [Snell, E.N., vol. v. (1891), p. 130, and vol. vii. (1893), p. 46 ; Figured, Webb, E.N., vol. vii., p. 121] : Wanstead ; (Crouch).

Family—LIMACIDAE.

Genus—LIMAX, Linné, 1785.

Limax maximus, Linné.
A.—Barking Side ; (Crouch).
B.—Finchingfield ; (Bailey) : *Colchester ; (Laver) : Broomfield) ; (W.M.W.) : Chignal ; (Christy) : Chelmsford ; Ingrave ; (W.M.W.).
C.—Saffron Walden ; (S.W. Museum).

Limax flavus, Linné.
A.—Barking Side—often grey in colour ; Crouch.
B.—Coggeshall ; (Turner) : Saling ; (Christy) : Colchester ; (Laver) : Chelmsford ; (W.M.W.).

Limax arborum, Bouchard-Chantereau (=*marginatus*, Müller).
B.—Saling ; Chignal ; (Christy) : Weald Hall Park, Brentwood ; (C.S.R., Christy) : Ingrave ; (W.M.W.).

[*Limax hedleyi*, Collinge.]

Genus—AGRIOLIMAX, Mörch, 1868.

Agriolimax agrestis, Linné.
A.—Barking Side; (Crouch): Leigh; (W.M.W.): Woodford ; (C.S.R., Oldham) : *Lea Valley ; (K. and W.) : Grays ; (Woodward).*

B.—Finchingfield; (Bailey): Halstead; (Adams): Coggeshall; (British Museum): Colchester; (Laver): Broomfield; (Christy): Chelmsford; Maldon; Margaretting; Ingrave; (W.M.W.): Weald Hall Park, Brentwood; (C.S.R., Christy): *Shalford; (W.M.W.): Witham and Copford; (K. and W.): Roxwell; (R. Christy).* [*Given in the Chignal list, but no specimens were forthcoming.*—W.M.W.]

C.—Saffron Walden; (S.W. Museum).

Agriolimax laevis, Müller.

A.—Redbridge Lane, Wanstead; (Crouch): Warley (W.M.W.).

B.—Halstead, on flags in river Colne; (Adams): Chelmsford (W.M.W.).

Genus—AMALIA, Moquin-Tandon, 1855.

[*Amalia gagates*, Draparnaud.]

Amalia sowerbii, Férussac (=*marginata*, Draparnaud).

A.—Barking Side; (Crouch).

B.—Chelmsford; Brentwood; (W.M.W.).

Genus—VITRINA, Draparnaud, 1810.

Vitrina pellucida, Müller.

A. Bishop's Stortford District; (Ingold): Farnham; (Hughes): Epping; (Newstead): Redbridge Lane, Wanstead: Whipps Cross: Barking Side; (Crouch): Warley (W.M.W.).

B. Finchingfield; (Bailey): Halstead; (Adams): Felstead; (French): Colchester; (Laver): Pleshey; (Christy): Langford: (Sheppard Collection): Quendon; (E.N., vol. x., p. 180): Chelmsford; (W.M.W.).

C. Saffron Walden; (S.W. Museum): Wrabness; (Sheppard and Collection).

Genus VITREA, Fitzinger, 1833.§

Vitrea crystallina, Muller.

A. Farnham: (Ingold): "Carswell," Barking Side; (Crouch): Beaumont: (Sheppard Collection): *Crossness: (Woodward): Walthamstow; (Tabor): (British Museum).*

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§ President's Address to Conchological Society, by Edgar A. Smith, F.Z.S. (*Journ. of Conch.*, vol. x., [illegible] p. [illegible]

B.—Snow's Lane, Felstead ; (French) : *Coggeshall ; (British Museum) : *Colchester ; (Laver) : Chignal ; (Christy) : Ingrave (W.M.W.) : *Felstead ; (French) : Shalford (W.M.W.) : *Copford ; Witham ; (British Museum) : Braintree ; (K. and W.) : Roxwell ; (R. Christy) : *Chignal : (Christy, 3).*

C.—Saffron Walden ; (S.W. Museum) : Stour Wood, Ramsey ; Wrabness ; (Sheppard Collection).

Vitrea cellaria, Müller.

A.- Bishop's Stortford ; (Ingold) : Hatfield Forest ; (E.N., vol. iv., p. 23) : Wanstead ; Barking Side ; (Crouch) : East Tilbury ; (E.N., vol. iv., p. 227) : *Lea Valley ; (K. and W.) : Crossness ; (Woodward).*

B.—Finchingfield ; (Bailey) : Felstead ; (French) : Coggeshall ; (E.F.C. Museum) : Colchester : Walton-on-the-Naze ; (Laver) : Broomfield ; Chelmsford ; (W.M.W.) : South Weald ; Doddinghurst ; (C.S.R., Christy) : Bulphan ; (C.S.R., Kew) : *Felstead ; (French) : Shalford (W.M.W.) : *Copford ; (British Museum) : Witham : (Woodward) : Chignal ; (Christy, 3) : Roxwell ; (R. Christy).*

C.—Saffron Walden ; (Christy) : Quendon (E.N., vol. v., p. 180) : or *V. nitida*, Ramsey Decoy, and Ramsey ; (Sheppard Collection).

[*Vitrea draparnaudi*, Beck.]

Vitrea alliaria, Miller.

A.—[(Bishop's Stortford recorded in error, Ingold) : Wanstead Park ; Barking Side ; (Crouch) : Chingford ; (C.S.R., Kew).

B.—Finchingfield ; (Bailey) : Felstead ; (French) : Coggeshall ; (British Museum) : [Colchester ; (Laver). N.B. Dr. Laver's specimens labelled *alliaria* were *glabra* and *cellaria*] : Chipping Hill, Witham : (Turner).

C.—([The specimens labelled *alliaria*, from Saffron Walden, in the Museum there, belong to several other species W.M.W.) : Wrabness ; (Sheppard Collection).

Vitrea glabra, British authors.

B.—Felstead ; (French) : Coggeshall ; [illegible] : Colchester ; (Laver) : Chignal ; (Christy) : [illegible] (W.M.W.).

C.—Saffron Walden ; (Christy).

Vitrea nitidula, Draparnaud.

A.—Bishop's Stortford district; (Ingold): *Ilford; (K. and W.): Crossness; Docks; (Woodward): Grays; (Woodward after S. V. Wood).*

B.—Beaumont; (Sheppard Collection): Halstead; (Adams): Felstead; (French and C. R.): *Coggeshall; (British Museum): *Colchester; (Laver): Thorrington: (Sheppard Collection): Witham; (Turner): Chelmsford: (Christy): Maldon; Margaretting; (W.M.W.): Doddinghurst; (C.S.R., Christy); [*Felstead; (French): Shalford: (W.M.W.): *Copford; Witham: (British Museum): *Chignal: (Christy 3): Roxwell: (R. Christy).*

C.—Saffron Walden; (Christy): Wrabness; Ramsey; (Sheppard Collection).

Vitrea pura, Alder.

A.—High Beach, Loughton; (C.S.R., Kew): Warley; (W.M.W.).

B.—Felstead; (French): Colchester; (Laver): *Felstead: (French): Shalford; (W.M.W.): Copford: (British Museum): Roxwell: (R. Christy): *Chignal: (Christy. 3).*

C. Saffron Walden; (S.W. Museum, labelled *alliaria*).

Vitrea radiatula, Alder.

A. Barking Side; Wanstead Park; (Crouch): Warley: (W.M.W.): *Walthamstow: (British Museum): Grays: (Woodward, after S. V. Wood).*

B. Felstead; (French): Beaumont; (Sheppard Collection): Walton-on-the-Naze; (C.S.R., Babington): *Coggeshall; (E.F.C. Museum): Colchester; (Laver): *West Bergholt (Laver Coll.); *Shalford; (W.M.W.): Copford: Witham: Roxwell: (R. Christy): *Chignal: (Christy. 3).*

C. Saffron Walden: (S.W. Museum): Stour Wood: Ramsey: Wrabness: (Sheppard Collection).

[Vitrea excavata, Bean.]

A. Recorded in error for ‡Bishop's Stortford district (Ingold).

B. *Copford: (K. and W.): †Chignal (in Christy Coll., 3—W.M.W.).*

Vitrea nitida, Müller (=*lucida*, Draparnaud).

A. Wanstead Park: (Crouch): *Canning Town: (K. and W.): Ilford: (British Museum: not mentioned by Woodward): Walthamstow: (British Museum): Docks: Crossness: (Woodward).*

B.—Felstead ; (French) : *Coggeshall ; (British Museum :) Colchester ; (Laver) : Witham ; (Turner) : **Copford ; (British Museum) : Chignal ; (Christy, 3).*

C.—Saffron Walden : (S.W. Museum).

Vitrea fulva, Müller.

A.—High Beach, Loughton ; (C.S.R., Kew) : Warley ; (W.M.W.) : *Lea Valley ; (K. and W.) : Ilford ; Crossness ; (Woodward) : Grays ; (Woodward, after S. V. Wood).*

B.—*Coggeshall ; (E.F.C. Museum) : Colchester ; (Laver) : *West Bergholt ; (Laver Coll.) : Ingrave ; (W.M.W.) : *[Felstead : (French) :] Shalford ; (W.M.W.) : *Copford ; Witham : (British Museum) : Chignal : (Christy, 3.).*

Family—HELICIDAE.

Genus—**ARION,** Férussac, 1819.

Arion ater, Linné.

A.—Woodford ; (C.S.R., Oldham) : Wanstead—rufous, variation ; (Crouch) : Warley—and rufous variation ; (W.M.W.).

B.—Halstead ; (Adams) : Colchester ; (Laver), (Brown variation, Adams) : Chelmsford ; Brentwood ; (W.M.W.).

C.—Saffron Walden ; (C.S.R., Ashford) : Stour Valley ; (C.S.R., Rope).

[*Arion elongatus*, Collinge.]

[*Arion flagellus*, Collinge.]

Arion hortensis, Férussac.

A.—Wanstead ; Barkingside ; (Crouch).

B.—Finchingfield ; (Bailey) : Colchester ; (Laver) : Broomfield (W.M.W.).

Arion circumscriptus, Johnston (=*bourguinati*, Mabille : *faciatus*, Nilson ; *ambiguus*, Pollonera).

A.—Navestock ; (W.M.W.).

B.—Coggeshall (specimens from Turner) : Springfield : Maldon—fine specimens ; Chelmsford : Widford ; Brentwood ; (W.M.W.).

[*Arion intermedius*, Normand.] (=*minimus*, Simroth).

[*Arion lusitanicus*, Mabille.]

Arion subfuscus, Draparnaud.

A.—Warley : (W.M.W.).

Genus—GEOMALACUS, Allmann, 1846.

[*Geomalacus maculosus*, Allmann.] Ireland contains the only British localities.

Genus—PUNCTUM, Morse, 1864.§

Punctum pygmaeum, Draparnaud.

A.—Farnham; (Ingold): High Beach, Loughton; (C.S.R., Kew): Warley; (W.M.W.)

B.—Chelmsford; (W.M.W.): *Copford: Witham: (British Museum): Shalford; (W.M.W.): *Chignal: (Christy. 3.).*

C. Saffron Walden: (S.W. Museum): Wrabness: (Sheppard): Ramsey; (Sheppard Collection).

Genus PYRAMIDULA, Fitzinger, 1833.

Pyramidula rupestris, Draparnaud.

A.- Barking Side; (Crouch).

B. – [*No specimens were found in the Christy Collection from Chignal, though this species was recorded in the list.*

Pyramidula ruderata, Studer. Extinct in Britain.

B. *Copford: (British Museum).*

Pyramidula rotundata, Müller.

A. Bishop's Stortford; (Ingold): Epping; (Newstead): Chingford; (C.S.R., Kew): Wanstead; (Crouch): Leigh; Warley; (W.M.W.): *Walthamstow: (British Museum): Canning Town: (K. and W.): Docks: Crossness: (Woodward).*

B. Felstead: (French): Coggeshall: (British Museum): Colchester: (Laver): Witham: (Turner): Chelmsford: (Christy): Margaretting: Ingrave; (W.M.W.): *Felsted: (French): *Copford: (British Museum): Clacton: [illegible]: (K. and W.): Shalford: (W.M.W.): Chignal: (Christy 3.): [illegible]: (R. Christy).*

C. Saffron Walden: (C.S.R., Ashford): Ramsey; (Sheppard and Collection): Wrabness; (Sheppard Coll.).

Genus—EULOTA, Hartmann, 1842.

[**Eulota fruticum**,, Muller. This snail is extinct in Britain.

A. *Ilford: (British Museum).*

B. Mr. [illegible] (E. N., vol. iii. [illegible], p. 101) says that at a point seven miles [illegible] Colchester in a deposit of marl and peat, "some of the [illegible] other than *H. rufescens*, but none were [illegible] determined, which I now regret."

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§ The [illegible] were, until recently, included in *Hel*[illegible]

Genus—HELICELLA, Férussac, 1842.

Helicella virgata, Da Costa.

A.—Paglesham—on clay ; (Laver) : Barking Creek ; (Crouch) : Canvey Island ; (Christy) : Southend ; (E.N., vol. vi., p. 3) : *Ilford ; (K. and W.).*

B.—Finchingfield ; (Bailey) : Stebbing ; (French, E.N., vol. vi., p. 3) : Felstead ; (French) : Little Tey ; (Adams) : Colchester ; *Walton ; Clacton—on cliffs of London clay ; (Laver) : *Mersea ; (Cole) : Chignal Smealey ; Saling ; Chelmsford—unstriped ; (Christy).

C.—Saffron Walden ; (S.W. Museum).

Helicella ericetorum, Müller.

A.—Bishop's Stortford District : (Ingold) : Farnham and Elsenham ; (Hughes) : Hatfield Forest ; (E.N., vol. ix., p. 222) ; Fyfield—unstriped ; (Christy) : *West Thurrock : (British Museum).*

B.—Dunmow ; (Christy) : Felstead—very local ; (French) : *Stanway ; Marks Tey ; (Laver) : Witham ; (Turner) : Chignal ; (Christy) : [*Felstead ; (French.)*]

C.—Saffron Walden (S.W. Museum).

Helicella caperata, Montagu.

A.—Farnham ; (Ingold) : Norton Heath, Ongar ; (Christy) : Paglesham ; (Laver) : Stifford ; Grays ; (Crouch) : *Lea Valley ; (K. and W.) : Ilford : Grays : (British Museum).*

B.—Finchingfield ; (Bailey) : Felstead : (French) : *Walton :* (C.S.R., Whitwell) : *Stanway Green : Colchester ; (Laver) : Witham ; Rivenhall ; (Turner) : Chelmsford ; (W.M.W.) : Chignal ; (Christy) : Doddinghurst : (C.S.R., Christy) : [*Felstead ; (French) :*] **¹Copford : (W.M.W., in material given to the Field Club by W. Whitaker, F.R.S. Mr. Kennard has also made out this species) : Clacton : (Webb 4) : Witham ; (British Museum) : [illegible] specimens forthcoming from Chignal.*

C.—Saffron Walden ; (S.W. Museum) : Wrabness : (Sheppard Collection) : Dovercourt : (Adams).

[*Helicella barbara,* Linné] (=*Bulimus acutus,* Müller.)

Helicella cantiana, Montague.

A.—Bishop's Stortford ; (Ingold) : Wanstead : Barking ; St[illegible] : Leytonstone : East Ham : (Crouch) : Stanford-le-Hope : (Cole) : Bulphan ; (C.S.R., Kew) : Leigh : (W.M.W.).

B.—Finchingfield; (Bailey): Saling—and albino; (Christy): Coggeshall; (Adams): Colchester; (Laver): Mersea; (Cole): Wyvenhoe; (W.M.W.): Copford; (British Museum): Walton; (C.S.R., Whitwell:) Kelvedon: Witham; (Turner): Brightlingsea—with very dark markings on the body which showed through the shell; (W.M.W.): Chignal; Chelmsford; (Christy): Springfield; Broomfield; (W.M.W.): Doddinghurst; (Christy): [*Felstead; (French)?*].

C.—Saffron Walden—and albino; (Christy): Quendon; (E.N., vol. v., p. 180).

Helicella carthusiana, Müller.

B.—Felstead—one dead shell from a hedge-row; (French): [*Felstead; (French)*. A note from Mr. French says that he "found but one specimen . . . and that was in a shell marl."]

C.—Saffron Walden; (S.W. Museum). These specimens are correctly determined.—W.M.W.

Genus—HYGROMIA, Risso, 1826.

Hygromia fusca, Montagu.

C.—Saffron Walden; (S.W. Museum). Two specimens.—W.M.W.

Hygromia granulata, Alder (=*sericea*, Draparnaud).

A.—Barking Side; (Crouch).

B.—Felstead; (French): Coggeshall; (British Museum): *Felstead; (French): Copford; (British Museum): *Chignal; (Christy 3): no specimens were forthcoming so labelled, but some were found among the Hygromia hispida.*—W.M.W.

C.—Saffron Walden; (S.W. Museum).

Hygromia hispida, Linné + **concinna**, Jeffreys.

A.—Bishop's Stortford—[not *concinna*; (Ingold): Chingford: (C.S.R., Scharff): Wanstead Park; Barking Side—+*concinna*: (Crouch): Redbridge Lane, Wanstead: (Crouch): *Ilford: Walthamstow*—+*concinna; Crossness: Dock*—*concinna* only: *Grays*; (*Woodward after P. J. Morris*), *concinna*: (*British Museum*).

B.—Felstead; (French): *Coggeshall—+*concinna; (British Museum): Colchester; (Laver): *concinna* (Laver and British Museum): Kelvedon; (Turner): Broomfield—and albino: (W.M.W.): Springfield—in the stomach of a frog; (W.M.W.): Chelmsford; (Christy): Doddinghurst; (C.S.R., Christy): Ingrave; (W.M.W.): [*Felstead; (French)*:] *Copford; (British Museum): Shalford; (W.M.W.); Clacton; (K. and. W): Witham; (British Museum) + concinna: (K. and W.): *Chignal; (Christy, 3, no concinna forthcoming. W.M.W.); Roxwell; (R. Christy).*

C.—Saffron Walden; (S.W. Museum): Quendon; (E.N., vol. v., p. 180): Wrabness; (Sheppard Collection): Ramsey; (Sheppard).

[*Hygromia revelata*, Férussac.]

Hygromia rufescens, Pennant.

A.—Bishop's Stortford; (Ingold): *Docks: Crossness; (Woodward).*

B.—Finchingfield—and albino; (Bailey): Halstead: (Adams): Lindsell; Saling; (Christy): Felstead; (French): *Coggeshall; (British Museum): Wickham Bishops; Faulkbourne; Terling; Fairstead; Great and Little Braxted; Rivenhall; Kelvedon: Markshall; Pattiswick: Bradwell; (Turner): Little Waltham; (Christy): Springfield); (W.M.W.): [*Felstead; (French)*:] *Copford; Witham; (British Museum): Shalford; (W.M.W.): Chignal: (Christy, 3): Roxwell: (R. Christy).*

C.—Saffron Walden; (S.W. Museum): and albino: (Christy): Audley End; (C.S.R., Christy): Langham: (C.S.R., Rope): Quendon; (E.N., vol. v., p. 180).

Genus—ACANTHINULA, Beck, 1837.

Acanthinula aculeata, Müller.

A.—Farnham; (Ingold): Stanstead Mountfitchet: (Hughes): High Beach, Loughton; (C.S.R., Kew): Epping: Newstead): Warley; (W.M.W.).

B.—Colchester, very rare; (Laver): Chignal; (Christy): **Felstead; (French): Copford; Witham; (British Museum): Shalford; (W.M.W.): *Chignal: (Christy, 3).*

C.—Saffron Walden; (S.W. Museum).

[**Acanthinula lamellata**, Jeffreys.] Living as far south as Staffordshire, J. of Conch, vol. vi. (18[illegible]), p. 254.

A.—*Walthamstow; (British Museum).*

B.—*Bushey Leys; *Felstead; (French): *Copford; (British Museum): Shalford; (W.M.W.): *Chignal; (Christy, 3): Roxwell; (R. Christy).*

Genus—VALLONIA, Risso, 1826.

Vallonia pulchella, Müller + **costata.**

A.—Farnham; (Ingold): Roding Meadows, Wanstead; Barking Side; (Crouch): East Tilbury; (E.N., vol. iv., p. 227): *Warley; (W.M.W.): Canning Town; (K. and W.): Ilford; Walthamstow: (British Museum): Crossness: (Woodward): Grays and Tilbury: (British Museum).*

B.—Felstead; (French): *Coggeshall; (British Museum): Colchester—and ribbed variation; (Laver): Pleshey Mount—and ribbed variation; (Christy, see also figure in Taylor's *Monograph of the Land and Freshwater Mollusca of the British Isles*, vol. i., 1894, p. 27): Chelmsford: (Christy): **Felstead; (French): *Copford: (British Museum): *Clacton; (Webb, 4, and British Museum): Witham: (British Museum): Shalford: (W.M.W.): *Chignal: (Christy, 3): Roxwell; (R. Christy).*

C.—Saffron Walden; (S.W. Museum): Wrabness; (Sheppard Collection): *Harwich; (British Museum).*

Genus HELICODONTA, Férussac, 1819.

[*Helicodonta obvoluta*, Müller.] Living only in Hampshire and Sussex. Fossil from Barnwell, Cambridgeshire.

Genus HELICIGONA, Férussac, 1819.

Helicigona lapicida, Linné.

A.—Elsenham; (Hughes): Hallingbury; (Ingold): *Canning Town; (K. and W.): Crossness: (Woodward).*

B.—Wimbish—"no keel;" (Christy): Sible Hedingham—"dead shells;" (Adams): Finchingfield; (Bailey): Felstead; (French): *Coggeshall; (Turner): *Colchester: (Laver, E.N., vol. vii., p. 67): Layer-de-la-Haye—"one dead shell;" (Laver): Chignal; (Christy): Chelmsford: (Turner): Doddinghurst—"one dead shell;" (C.S.R., Christy): *Felstead: (French): *Copford; (British Museum: Chignal: (Christy, 3): Roxwell; (R. Christy).*

C.—Saffron Walden: (S.W. Museum and Christy).

Helicigona arbustorum, Linné.

A.—*Ilford ; Canning Town ; (K. and W.) : Walthamstow : (British Museum) : Crossness ; (Woodward) : Grays ; (Woodward after S. V. Wood).*

B.—Felstead ; (French) : *Colchester—"not rare, but local ;" (Laver) ; Coggeshall—yellow variation ; Chipping Hill and Dick Mead, Witham ; (Turner) : Pleshey ; Chignal ; Chelmsford ; (Christy) : [*Felstead ; (French) :*] **Copford ; Witham ; (British Museum) : *Chignal ; (Christy, 3).*

C.—Saffron Walden ; (S.W. Museum).

Genus—**HELIX,** Linné, 1758.

Helix aspersa, Müller.

A.—Bishop's Stortford ; (Ingold) : Hatfield Forest ; (E.N., vol. iv., p. 223) : Wanstead ; Barking Side—one reversed specimen ; (Crouch) : Buckhurst Hill ; (Cole) : *Lea Valley ; (K. and W.).*

B.—Felstead ; (French) : Coggeshall ; (Adams) : Colchester, albinos in Trinity Churchyard ; (Laver) : *East Mersea ; (Cole) : Walton ; (C.S.R., Whitwell) : Kelvedon ; Witham ; Hatfield ; Wickham Bishops ; Faulkbourne ; Terling ; Fairstead ; Great and Little Braxted ; Rivenhall ; Feering ; Markshall ; Pattiswick ; Bradwell ; (Turner) : Springfield—in the stomach of a frog ; (W.M.W.) : Chignal ; Broomfield ; Chelmsford ; South Weald ; (Christy) : Brentwood ; (W.M.W.) : [*Felstead ; (French) : almost certainly from top-soil.*]

C.—Saffron Walden ; (S.W. Museum and Christy).

Helix pomatia, Linné.

Within half-a-mile of the Essex border at Upwick Green (Ingold).

B.—Great Bardfield—two specimens ; (Saffron Walden Museum). N.B.—It is possibly a coincidence, but several years ago the Reverend George Bailey gave some specimens of *Helix pomatia* (not from Essex) to some children at Great Bardfield : *Chappel—specimens were sent to the writer by Miss Anna Agerth, who found it in some numbers on a waste piece of land forming the bank of a lane near Chalkney Wood, Chappel—see figure 107 in *Journ. Essex Tech. Labs.*, vol. ii., p. 241 : the writer had heard previously of the occurrence of this snail at Chalkney Wood from Mr. Turner, who gave Dr. Gimson, of Witham, as his authority. (W.M.W.) : Hoe Lane, Witham—two specimens; (Turner) : Chignal Smealey—one specimen; (Christy).

Helix nemoralis, Linné.

A.—Bishop's Stortford; (Ingold): 12345, Hughes: Hatfield Forest—red 00300; (E.N., vol. iv., p. 223): Epping; (Newstead): Wanstead; (Crouch): Langdon Clay, 00300 yellow and red; (Christy): Wanstead; (Crouch): Leigh; (W.M.W.): *Canning Town; (K. and W.): Ilford: Walthamstow; Crossness; Docks; Grays; (British Museum).*

B.—Yeldham; (Adams): Finchingfield; (Bailey): Bardfield, 12345, in company with *Helix hortensis*; Radwinter—00000 red, in company with *Helix hortensis* and its red-lipped variation; (Christy): Felstead; (French): Coggeshall; Little Tey; (Adams): Colchester; (Laver): East Mersea; (Cole): Clacton; (Christy): Maldon, 003300; (W.M.W.): Witham; Faulkbourne; Terling; Fairstead; Great and Little Braxted; Hatfield; Wickham Bishops; Rivenhall; Kelvedon; Feering; Markshall; Pattiswick Bradwell; (Turner): Chelmsford—12345 and conoid variations, 00000 red, 00000 brown; (Christy): 00345; (W.M.W.): Chignal— (12345), (123) (45), 02345, 00340, 00340 with dotted bands 02340, 00300, 00000 red, 0(23)45): Roxwell—(12)3(45); (Christy): [*Felstead: (French)*:] **Copford*: *Walton* [*? Clacton*]: *(British Museum)*: **Clacton*; *(Webb, 4)*: *Shalford*: *(W.M.W.)*: *Witham*: *(British Museum)*: **Chignal*; *(Christy, 3)*: *Roxwell*: *(R. Christy)*.

C.—Chesterford—12345, at lip (12345); 00300, red; Ashdon, 12345, (12)345, and Buccany Barn Lane, Saffron Walden, with *Helix hortensis* and its red-lipped variation: Wicken, 00000, yellow and red; (Christy): Wrabness; (Sheppard Coll.): Ramsey—00000, 00300, 12345; (Sheppard, who thought these three variations to be species): Saffron Walden; (S.W. Museum): Quendon; (E.N., vol. v., p. 180): *Harwich; (British Museum).*

Helix hortensis, Müller.

A. Bishop's Stortford: (Ingold): Epping; (Newstead): East Ham, Leyton: Leytonstone; (Crouch).

B. Radwinter, with *Helix nemoralis*, 12345, (123)45, (123)(45), with almost colourless bands, 00000 and with pink lip: Wimbish—00000 with pink lip; Bardfield—00000, one with orange varix, 10005, 00000 with pink lip, in company with *Helix nemoralis*; (Christy): Yeldham; (Adams): *Castle Hedingham; (Cole): Finchingfield; (Bailey): Felstead; (French): Stebbing—10005, 00000 with pink lip; (Christy): Coggeshall; Little Tey; (Adams): Colchester; (Laver): Walton; (C.S.R., Whitwell): Witham; Hatfield; Wickham Bishops; Faulkbourne; Terling; Fairsted; Great and Little Braxted; Rivenhall; Kelvedon; Feering; Markshall; Pattiswick; Bradwell; (Turner): Great Waltham—1(234)5, with almost colourless bands; Chignal—12345, 00000; Chelmsford—00000 brown, 00000 with pink lip; Billericay—00000; (Christy): [*Felstead; (French):*] **Copford; (British Museum): *Clacton; (Webb, 4): Chignal; (Christy, 3).*

C.—Bartlow—00000; Ashdon—00000 pink lip; *Saffron Walden; (S.W. Museum); 00000 and with pink lip [12345, (123)(45), with white zone, 10345 all with almost colourless bands]; (Christy): Quendon; (E.N., vol. v., p. 180): Ramsey; (Sheppard).

[*Helix pisana*, Müller.] Recorded in error by French for ‡ Felstead. This species occurs at Dublin, Tenby, and in the Channel Isles.

Genus—BULIMINUS, Beck, 1837.

Buliminus montanus, Draparnaud.

Essex; (British Museum).

B.—*Copford; (K. and W.).*

Buliminus obscurus, Müller.

A.—Bishop's Stortford District; (Ingold): Broxted; (Hughes): Redbridge Lane, Wanstead; (Crouch).

B.—Felstead; (French): Coggeshall; (British Museum): Colchester; (Laver): Pleshey Mount—one of three species showing the albino variation [see Proc. Essex Field Club, vol. iii., *p. xciii.*]; Chignal; (Christy): Chelmsford; (W.M.W.): *Copford; (British Museum).*

C.—Saffron Walden; (S.W. Museum): Wrabness—attention is drawn to the fact that this species plasters its shell with mud ["adventitious protection" of Poulton]; (Sheppard and Collection).

Family—PUPIDAE.

Genus—**PUPA,** Draparnaud, 1805.

[_Pupa secale_, Draparnaud.]

[Pupa anglica, Férussac.] (=_ringens_, Jeffreys.)

B.—*_Bushey Leys, Felstead ; (French) : Copford, one specimen ; (British Museum) : Shalford ; (W.M.W.)._

Pupa cylindracea, Da Costa (=_umbilicata_, Draparnaud).

A.—Redbridge Lane, Wanstead ; (Crouch) : _Ilford ; (K. and W.)._

B.—Causeway End ; (French) : *Colchester, Castle and Roman wall ; (British Museum and Laver) : [_Felstead ;_ (French) :] _Copford ; (British Museum) : Shalford ; (W.M.W.) : *Chignal—young specimens ; (Christy, 3 :) Roxwell ; (R. Christy)._

C.—Saffron Walden ; (S.W. Museum).

Pupa muscorum, Linné.

A.—Farnham ; (Ingold) : East Tilbury ; (E.N., vol. iv., p. 227) : _Ilford ; (Woodward after A. Tylor) : Walthamstow ; Crossness ; Grays ; West Thurrock ; (British Museum)._

B.—*Colchester Castle ; (Laver) : Colchester, Roman wall ; (British Museum and Laver) : Brightlingsea—on the shore of the creek) ; (W.M.W.) : Chignal ; (Christy) : Chelmsford ; (W.M.W.) : [_Felstead ; (French)_ :] _*Copford ; *Clacton ; (British Museum) : Witham ; (K. and W.) : *Chignal ; (Christy, 3) : Chelmsford ; (Webb, 5)._

C.—Saffron Walden ; (S.W. Museum) : Wrabness Point—under water at high tide ; Harwich Cliff ; (Sheppard and Collection) : Dovercourt ; (Adams).

Genus—**VERTIGO,** Müller, 1774.

Vertigo edentula, Draparnaud.

A.—Epping ; (Newstead) : High Beach, Loughton ; (C.S.R., Kew) : Warley ; (W.M.W.) : _Crossness ; (British Museum)._

B.—_Copford ; (British Museum) : Shalford_ ; _(W.M.W.) *Chignal ; (Christy, 3)._

C.—Saffron Walden ; (C.S.R., Ashford) : Wrabness ; Stour Wood, Ramsey ; (Sheppard Collection) : Ramsey Decoy ; (Sheppard).

[_Vertigo minutissima_, Hartmann.]

Vertigo antivertigo, Draparnaud.

A.—St. Swithin's Farm, Barking Side ; (Crouch) : _Ilford ; (Woodward after A. Tylor) : Walthamstow ; (British Museum) : Grays ; (Woodward after S. V. Wood)._

B.—[*Felstead ; (French)*] : **Copford ; Witham ; (British Museum) ; Shalford ; (W.M.W.)* : **Chignal ; (Christy, 3).*

C.—By the River Stour ; Wrabness ; (Sheppard and Coll.) : *Harwich ; (K. and W.)*

Vertigo substriata, Jeffreys.

A.—High Beach, Loughton ; (C.S.R., Kew) : St. Swithin's Farm, Barking Side— 2 specimens ; (Crouch) : *Warley —fairly abundant ; (W.M.W.) : *Crossness ; (Woodward) : Grays ; (Woodward after A. Tylor).*

B.—**Felstead ; (French) :* **Copford ; Witham ; (British Museum) : Shalford ; (W.M.W.) :* **Chignal ; (Christy, 3.)*

Vertigo pygmaea, Draparnaud.

A.—Farnham ; (Ingold) : St. Swithin's Farm, Barking Side ; (Crouch) : Leigh ; (W.M.W.) : *Walthamstow ; (British Museum).*

B.—Chelmsford ; *Ingrave ; (W.M.W.) : **Felstead ; (French) :* **Copford ; (British Museum) :* **Chignal ; (Christy, 3) : Roxwell ; (R. Christy).*

[*Vertigo alpestris,* Alder.]

Vertigo moulinsiana, Dupuy.

A.—*Roydon ; (Laver Coll.).

B.—**Copford ; (British Museum) :* **Clacton ; (Webb, 4) :* *†*Chignal ; (Specimen found in Christy Coll., 3—W.M.W.)*

Vertigo pusilla, Müller.

A.—*Crossness ; (British Museum) : Grays ; (Woodward after S.V. Wood).*

B.—Barfield (*sic*) [? Bardfield] ; (French) : **Copford ; (British Museum) : Shalford ; (W.M.W.) :* **Chignal ; (Christy, 3).*

[**Vertigo angustior,** Jeffreys.]

B.—†*Bushey Leys, Felstead ; (C.S.R., French) :* **Copford ; (British Museum) :* **Clacton ; (Webb, 4) : Witham ; (British Museum) :* **Chignal ; (Christy, 3).*

C.—*Harwich ; (British Museum).*

Genus—**BALEA,** Prideaux, 1824.

Balea perversa, Linné.

A.—Epping ; (Newstead) : Redbridge Lane, Wanstead ; (Crouch) : *Crossness ; (Woodward) : Grays ; (Woodward after S. V. Wood).*

B.—Coggeshall; (British Museum): *West Mersea; (Laver): Danbury; (Hughes): Chignal; Little Baddow; (Christy): [*Felstead; (French)*:] (**The specimens from Chignal labelled Balea perversa were young Clausiliae*—*W.M.W.*)

C.—Saffron Walden; (S.W. Museum).

Genus—**CLAUSILIA**, Draparnaud, 1805.

Clausilia laminata, Montagu.

A.- Broxted; (Hughes): *Walthamstow; (British Museum)*: *Canning Town: (K. and W.)*: *Crossness: Docks; (Woodward)*.

B. Lindsell; (Christy): Felstead; (French): Beaumont; (Sheppard Coll.): Coggeshall; (British Museum): Chignal; (Christy): **Copford: (British Museum)*: **Chignal: (Christy, 3)*: *Shalford: (W.M.W.)*: *Roxwell: (R. Christy)*.

C. Saffron Walden; (S.W. Museum).

[*Clausilia biplicata*, Montagu.] Putney; (Kensington Gardens?): Easton Grey, Wiltshire—are some of the few British localities for this shell.

Clausilia bidentata, Ström. (=*rugosa*, Draparnaud).

A. Bishop's Stortford; (Ingold): Hatfield Forest: (E.N., vol. iv., p. 223): Epping; Barking Side; (Newstead): Redbridge Lane, Wanstead; (Crouch): *Crossness: (Woodward)*.

B.- Felstead; (French): Beaumont; (Sheppard Coll.): Coggeshall: (British Museum): Colchester; (Laver): *Birch: (Laver Coll.): Kelvedon: Witham; (Turner): Maldon; (C.S.R., Darbishire): Pleshey: Chignal: Broomfield in the crop of a blackbird with *Hygromia hispida*: Chelmsford: (Christy): [*Felstead: (French)*:] **Copford: (British Museum)*: *Witham: (K. and W.)*: *Shalford; (W.M.W.)*: **Chignal: (Christy, 3)*: *Roxwell: (R. Christy)*.

C.—Saffron Walden; (S.W. Museum): Wrabness; Ramsey: (Sheppard Collection).

[**Clausilia rolphii**, Gray.]

B.—[*Felstead: (French)*:] *Copford: Witham: (British Museum)*.

(*Clausilia pumila*, Ziegler.) A form extinct in Britain, but occurring fossil at Crayford and Barnwell, and shown to be distinct from *Clausilia biplicata* by B. B. Woodward. *Proc. Geol. Assoc.*, vol. x., No. 7, p. 357.

Family—STENOGYRIDAE.

Genus—COCHLICOPA (Férussac part), Risso, 1826.

Cochlicopa lubrica, Müller.

A.—Farnham ; (Ingold) : Warley ; (W.M.W.) : Chingford ; (C.S.R., Scharff) : Wanstead Park ; (Newstead) : Wanstead ; Barking Side ; (Crouch) : *Ilford ; Walthamstow ; (British Museum) : Canning Town ; (K. and W.) : Crossness ; Grays ; (Woodward).*

B.—Felstead ; (French) : *Coggeshall ; (Adams) : Colchester district ; (Laver) : Pleshey Mount—with the hyaline variation ; and the albinos of two other species ; (Christy, Chelmsford ; Ingrave ; (W.M.W.) : *Felstead ; (French)* : **Copford ; Witham ; (British Museum) : Shalford ; (W.M.W.)* : **Chignal ; (Christy, 3) : Roxwell ; (R.Christy).*

C.—Saffron Walden ; (S.W. Museum) : Wrabness ; (Sheppard Collection).

Genus—AZECA (Leach), Flemming, 1828.

Azeca tridens, Pulteney.

A.—Farnham ; (Ingold) : Between Elsenham and Broxted ; (Hughes).

B.—Leigh's Priory, Felstead ; (French) : Coggeshall ; (Adams) : Pleshey Mount—with hyaline variation ; and albinos of *Cochlicopa lubrica* and *Buliminus obscurus ;* (Christy) : [*Felstead ; (French)* :] **Copford ; (British Museum) : Chignal ; (Christy, 3) : Roxwell ; (R. Christy).*

C.—Saffron Walden ; (S.W. Museum).

[*Azeca elongata,* Taylor] described from two specimens, see *The Naturalist,* March, 1897, p. 75.

Genus—CAECILIANELLA.

Caecilianella acicula, Müller.

A.—Farnham ; (Ingold) : East Tilbury—in a human skull ; (Cole, E.N., vol. iv., p. 227).

B.—Leigh's Priory, Felstead ; (French) : Colchester ; (Laver) : [*Felstead ; (French)* :] *Witham ; (K. and W.) : Chignal ; (Christy, 3).*

C.—Arkesden ; (S.W. Museum) : Wrabness ; (Sheppard Coll.).

Family—SUCCINEIDAE.

Genus—SUCCINEA, Draparnaud, 1801.

Succinea putris, Linné.

A.—Thorley and Hallingbury ; (Hughes) : Roding Meadows ;

(Crouch): Essex Marshes; (Jenkins): *Ilford; Walthamstow: (British Museum): Canning Town; (K. and W.): Docks; (Woodward after Blandford): Grays: (Woodward after Morris).

B.—Halstead; (Adams): Felstead; (French): Coggeshall; (Turner): Colchester; (Laver): *Mersea; (Cole): Clacton; (C.S.R., Whitwell): Witham; Messing; (Turner): Chignal—thirty-six specimens in the crop of a ring-dove; (Christy): River Chelmer; (E.N., vol. v., p. 233): Broomfield; (E.N., vol. vii., p. 76): Chelmsford; (W.M.W.): [*Felstead; (French):*] **Copford: Witham; (British Museum): Chignal; (Christy, 3): Roxwell; (R. Christy).*

C.—Saffron Walden; (S.W. Museum): Haverhill—one albino specimen; Birdbrook; (Adams): Ramsey Decoy; (Sheppard Coll.).

Succinea elegans, Risso.

A.—Banks of the River Stort; (Ingold): Ilford; (C.S.R., Darbishire): Dagenham; (C.S.R., British Museum): Roding Meadows; (Crouch): Essex Marshes; (Jenkins): *Tilbury; (?): *Ilford; (W.M.W., Journ. of Malac., vol. vi., p. 30): Lea Valley: (K. and W.): Crossness; Docks: (Woodward).*

B. Halstead; (Adams): Felstead; (French): *Colchester: (Laver): Chignal; (Christy): Broomfield; (W.M.W.): [*Felstead; (French):*] **Copford; (British Museum): Chignal: (Christy, 3): Chelmsford: (Webb, 5).*

C. Haverhill; Birdbrook: (Adams): *Harwich; (K. and W.).*

[**Succinea oblonga,** Draparnaud.] The specimens in Saffron Walden Museum were wrongly determined.

B. *Chelmsford: (Webb, 5).*

(b) *DIGONOPORA.*

Family—ONCIDIIDAE.

Genus—**ONCIDIELLA,** Gray, 1850.

[*Oncidiella celtica,* Cuvier.] Cornwall contains the only British locality.

Not recorded.

THE PALÆOLITHIC DEPOSITS AT HITCHIN, AND THEIR RELATION TO THE GLACIAL EPOCH.

[Report to the Royal Society by Mr. Clement Reid, F.L.S., F.G.S. of the Geological Survey.—*Proceedings of the Royal Society*, Vol. lxi., No. 369 (March 26th, 1897.)]

IN the Essex Naturalist of November, 1896 (vol. ix. pp. 245-47) is an account of some borings and excavations at Hoxne, on the northern border of Suffolk. The investigations at Hitchin in Hertfordshire, of which a brief notice is here given, were conducted by Mr. Clement Reid, who had the management of those at Hoxne, were in beds of similar age and character, and the results equally concern members of the Essex Field Club. For the Chalky Boulder Clay, which forms so large a proportion of the surface of Suffolk and Essex, extends also to Hertfordshire, and formed in both cases the best means of testing the age of the deposits associated with it in which the excavations were made.

Palæolithic implements have long been found at Hitchin, and the results of the Hoxne borings made it desirable to ascertain whether the conclusions derived from them would be confirmed by a similar exploration at Hitchin. Accordingly, at the instance of Sir Archibald Geikie, a grant of £50 was obtained from the Royal Society for that purpose.

A preliminary examination of the neighbourhood convinced Mr. Reid that the Palæolithic and ancient alluvial deposits occupied a small irregular valley which had become silted-up and almost obliterated. Difficulties arising from the "coarse, loose, and watery character of the strata," caused boring after boring, to be stopped by the closing in of the sides, and prevented the drawing of an accurate section across the old valley. Attention was therefore mainly directed to the relations of the Chalky Boulder Clay to the Palæolithic loams, and borings were made in the pits from which implements had been dug. Only one bore-hole passed through undoubted Boulder Clay, though in another "some blue chalky clay" was penetrated, and in a third, fossils derived from the Boulder Clay were found in the lower part of the alluvium. In each case boring was stopped by gravelly sand full of water. The section in which undoubted Boulder Clay appeared is here given :—

		Ft.	in.
Palæolithic.—	Yellow brick earth and small stones ...	14	6
Ancient Alluvium	Yellow and white marl and silt ...	2	0
	Yellow loam and small chalk pebbles	0	6
	Chalky Boulder Clay	9	0
	Loamy chalky gravel (base of the Boulder Clay	2	0
	Gravelly sand (boring stopped by large stones)	8	0
		36	0

The high level at which Chalky Boulder Clay was found, and its absence, or representation by material derived from it, at lower levels, in borings nearer the centre of the channel, suggests to Mr. Reid the conclusion that "the channel was, to a large extent excavated or re-excavated after the deposition of the Boulder Clay, as was the case at Hoxne."

The ancient river alluvium is entirely overlapped and hidden by the overlying Palæolithic brick earth. The trend of the buried channel is from south to north, and follows the general slope of the ground, and the course of existing streams. The stony brick earth yielded scarcely anything but Palæolithic implements, and the ancient alluvial deposits below, though full of plants and shells, were without any trace of man. The mammalian remains all came from the whitish marl and silt immediately below the Palæolithic brickearth. They consisted of *Ursus*, *Equus caballus*, Linn ; *Rhinoceros* ; *Hippopotamus* (a waterworn bone), *Cervus elaphus*, Linn ; and *Elephas primigenius*, Blumb.

Mr. Reid notices the striking general similarity between the beds at Hoxne and at Hitchin, and remarks that in each locality the same story is told. In his own words :—

" Some time after the passing away of the ice, the land stood higher than now, so that the streams had a greater fall, and valleys were cut to a somewhat greater depth. Then the land sank, and the valleys became silted up with layer after layer of alluvium, to a depth of at least 30ft., the climate remaining temperate. The next stage, when an Arctic flora re-appeared, is only represented at Hoxne. The third stage in the in-filling of the valleys is shown in the curious unstratified decalcified brickearth with scattered stones and Palæolithic implements, identical in character at Hitchin, Hoxne, Fisherton, and other localities, which irresistibly suggests a mingling of wind-transported material and rain wash."

A list of the fossil remains found, and the details of the various borings are given, but for these and other matters of interest, the reader must consult the paper itself. At Hitchin, as at Hoxne, Palæolithic implements have been found only in deposits decidedly Post-Glacial. It is pleasant to be able to congratulate Mr. Clement Reid on this most interesting and important investigation.

T. V. HOLMES.

THE FEDERATION IDEAL FOR NATURAL HISTORY SOCIETIES, WITH SPECIAL REFERENCE TO THE EASTERN COUNTIES.

By PROF. G. S. BOULGER, F.L.S., F.G.S. (*Vice-President*).

[*Read December 12th, 1896*].

IT is unnecessary to insist before this Club that the main *raison d'être* of a provincial Natural History Society is *local.* Educationally it may be concerned with Natural History in general, but so far as any original contributions to knowledge are concerned it should be exclusively local.

The British Association I look upon as the great peripatetic scientific missionary society to the large provincial centres; but, whilst in this capacity its business is to bring "home to Mens Businesse and Bosomes" the most recent advances of science in general, its Committees have been largely engaged in the systematic investigation of the natural phenomena of Britain. Now the value of a generalisation increases with the completeness with which the particulars embraced by it have been investigated. The results of these Committees of the British Association depend for their value, therefore, very largely on the complete extension of their purview over the whole country. Here it is that truly valuable contributions to science can be made by the co-operation, not only of those publishing societies which are at present affiliated to the British Association by means of its Committee of Delegates, but also of smaller societies, and of isolated individual workers. The ideal in this matter is, I take it, as implied in Mr. Abbott's paper, that the whole country should be parcelled out between working societies in touch with the Association. That this consummation may be reached would necessitate the formation of some new societies, and the rejuvenescence — to use a physiological metaphor—of many others; whilst in the case of societies, like our own, working a large area, a policy of decentralization will, I think, be to some extent necessary, if the work is to be efficiently carried out over the whole area.

The Yorkshire Naturalists' Union with its 27 affiliated societies, besides individual members, its joint monthly Journal and its Transactions, nearly approaches my ideal in this direction, and I should like to see not merely one flourishing County society in Norfolk, one in Suffolk, and our own Club in Essex; but—especially when one takes into consideration the great difficulties of cross-country travelling to attend evening meetings and committees—several societies in each county. Lynn, Hunstanton, Cromer, and Yarmouth ought to do something as well as Norwich; Lowestoft and Bury St. Edmunds as well as Ipswich; and Colchester, Saffron Walden, Braintree, Southend, Walthamstow, and Maldon as well as Chelmsford. It is a mere matter of name whether such local bodies of workers be called Committees of a County Club or Societies in a County Association[1]: but it is obvious that the essential pre-requisite for such a scheme is a body of workers over the whole area. This does not exist; but with increased missionary effort it could, I maintain, be brought into existence. And here I would say at once that I yield to no member of the Club and to no one outside the Club in my admiration of the work which we, as a Club, have been able to do in—I may also say, throughout—this county; but no one can be blind to the fact that a great—an undue—share of this work has depended upon the efforts of a very small proportion of our members. Now while experience shows that local societies never do flourish unless they have some devoted enthusiast to "run" them, it is, I believe, equally true that one of the most prolific causes of the demise of local societies is their degeneration—I use the term advisedly—into "one man shows."

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[1] In favour of the former alternative it may perhaps be urged that if local workers are only members of a Committee of a County Club their local enthusiasm will not tend to lessen the ardour of their zeal for the County, and the finances of the central organization will thus be in less danger.

Besides the onerous share in the corporate work of the society involved in the payment of his or her subscription, every member should try to contribute in some way to the original scientific work of the society. To encourage this I would suggest the taking a leaf out of the book of some of our religious bodies in increasing the number of office-holders. How would it be if three members are interested in some one scientific topic, such as erratic boulders, brambles, or manifestations of the aurora, to constitute them into a Committee with a Secretary—two to form a quorum—or if there are five or six members of our Club resident say at Braintree to constitute them into a local Reporting Committee?

In order to secure the local and special personal interest—or, I would rather say, enthusiasm—and work which we require, I am sure we cannot do better than continue and expand the practice of peripatetic meetings in various centres of our area—especially of meetings extending over more than one day—which we have long carried out; and I think that this practice requires to be extended into other counties. It is not perhaps until the second day of such a meeting that the town visited awakes to the presence of a body of scientific workers in their midst, and then the danger arises that with newly aroused enthusiasm and hospitality they may—with the best possible intentions—convert a scientific meeting into a picnic. It is, however, because we can hardly hope to secure Committees, even of three, in many outlying villages that I think a County Association should not only enrol affiliated societies as members—all that has, for instance, been as yet done by the South-Eastern Union—but should also enrol individual members—with, of course, any provision as to difference of voting and other privileges that may seem desirable. Besides the estimated 50,000 members of the Natural History Societies of the country there must, I am sure, be many isolated workers, and the want of communication between such workers and between neighbouring societies must lead to a good deal of overlap in work, of misdirected, and therefore of practically wasted, energy.

I am afraid that many members of this Club may—like other people—be keenly alive to the apathy of the people in Norfolk and Suffolk whilst looking at Essex through the rose-coloured spectacles of self-satisfaction. I would remind such members that if we are to have adequate national censuses on such subjects as those dealt with by British Association Committees it is not sufficient that Essex should be well surveyed; and that, if we are carrying out such work as it should be done within our own area, we should have scientific enthusiasm transcending county limits and "let our light shine before" Suffolk and Norfolk.

Seriously, there is much that we might do in the way of joint work and mutual help — more perhaps naturally with Suffolk, and perhaps Hertfordshire and Cambridgeshire, than with the more distant and not adjacent Norfolk. We share with these counties, for instance in the basin and estuary of the Stour, in the valley of the Lea, and, to a small extent, in that of the Cam. This at once suggests co-operation in recording rainfall, evaporation, flow of springs, and the amount and composition of river water, in that of the distribution of river molluscs and of river-side plants. To trace such phenomena as the two last-mentioned in detail would seem the best possible object for joint field-meetings and perhaps for a joint Committee. As an incidental personal grumble I may mention by the way that it is difficult to distinguish in the interesting account of one of the recent field-meetings of this Club on the Lea what observations were made in Hertfordshire and what in Essex. This is, I may say, a subject of peculiar interest to myself, as I should like to find out what degree of importance really attaches to the subdivision of counties for botanical purposes into river basins —a point which the late Professor Babington, living in Cambridge, in the midst of a level area, considered of little importance, whilst the Rev. Mr. Newbould thought it of the very highest. It would, I think, be a most useful fillip to societies if those whose areas are conterminous, held at least one joint field-meeting within the area of each society in every season.[2] In the South-eastern counties something has already been done in the way of forming and circulating a series of geological lantern-slides illustrative of the local formations and at the Congress at Tunbridge Wells last April, at which the South-Eastern Union was established, a suggestion of forwarding papers from one society to another for re-reading or exchanging lecturers was favourably received. A good deal has also been said as to joint action with regard to reduction of railway fares. Undoubtedly, however, one of the greatest—though one of the most difficult—reforms would be the formation of unions, like those of Yorkshire, Ireland, and Scotland, and the perhaps too large, and therefore defunct, one in the Midlands, for joint publication. The woes of the serious student of British Natural History as to the bulk of the "literature" with which he has to grapple have been often expressed; and perhaps the main crux in the matter of reducing the number of publications is a certain desire to see oneself in print and the consequently invidious task of the Publication Committee. This is not, however, I venture to think, insuperable. Experience has proved it. It should be clearly understood by all, that local reference, novelty, general importance to science and brevity will be considered—in the order named—the four chief recommendations of a paper for publication. With special reference to this topic I would, in concluding my general remarks, say a few words on the question of autonomy. Every society, however small, may well, I think, publish an annual report, provided it only contain a balance-sheet, a list of members, a list of meetings held and papers read, but no abstracts, reports, addresses, nor anything of any possible scientific importance; so that no one engaged in scientific research need look them up. This, and absolute freedom to make any rules as to membership, subscription, etc., would, I presume, be a guarantee of independence. A Congress, or separate and tediously corresponding general meetings would have to decide on the form, size, and price of a joint publication and a Joint Committee must to some extent edit it. This, and the periodical union *pro tem.* in a Congress, need be the only links binding the societies in a union. I have already hinted in the course of these general remarks at what I think might be done in the Eastern Counties. It would perhaps be well to seek the co-operation of Metropolitan societies, as well as of individuals. An annual East Anglian Congress and several joint field-meetings would be easily organised and perhaps it would be better to leave the question of joint publication for consideration at the second or third Congress—say from January 1st, 1900.

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[2] The holding of a Congress annually by invitation at some varying centre in a District Union for the reading of papers on organization, or on scientific questions of more than strictly local interest, and for visits to spots of scientific interest, I take to be a "counsel of perfection" rather than a *sine quâ non* to a Union. Here again, as in peripatetic missionary meetings within the area of one society, it will undoubtedly be most desirable to extend the meeting beyond a single day. The Devonshire Association, I am told, holds most successful gatherings of a week's duration, and we propose to attempt a two-days' Congress at Tunbridge Wells next May. Though the necessity for an invitation would perhaps confine such Congresses to active centres, they ought to have a greatly reviving effect upon moribund societies.

THE BIRDS IN EPPING FOREST.

The London naturalist may now rejoice in the knowledge of the existence in the Forest district of one of the largest protected areas for birds in England; a tract of about 20,000 acres in which the feathered race (with a few regretable exceptions) may find a relatively secure habitation. Mr. E. N. Buxton's plans and objects in the formation of the "Epping Forest Bird Protection League" were explained by himself at a meeting of the Essex Field Club in May, 1895 (see E.N., vol. ix., pp. 49-50), and we have now before us the first Report of the League, dated February 4th, 1897. It is distinctly encouraging. The Epping Forest Committee have cordially supported the idea, and we have reports from the keepers of nine "walks" in the forest proper, and from keepers in a like number of private estates surrounding the Forest, noting the presence or absence of the birds which it is especially desired to protect. The Schedule of observations is too full of detail to be given here, but it is exhibited in the Forest Museum at Chingford, and a few extracts will be of interest :—

Owls appear to be increasing. At Warlies, Barn Owls have been frequently seen; at Beech Hall they are "fairly plentiful," and greatly increased at Bishops Hall and Loughton Hall. In the forest almost every keeper notes that "brown and white owls" have been often seen. It is unfortunate that considerable indefiniteness as to the particular species attaches to most of the observations. This also applies to the *Hawks*; most of the observers report having seen Kestrels; a few record Sparrow-hawks, and at Warlies a pair of Sparrow-hawks brought off three young ones. Some *Magpies* have been seen, and in Wanstead Park it is said "two Magpies last year, now four." Mr. Buxton remarks that they were "exceedingly scarce before we commenced to protect them—only two or three pairs at the most being known to exist. We could not therefore expect that many would be seen after so short a time." Peewits are noted as plentiful on the Roding Marshes, and at Loughton Hall there was "a large increase." There were about sixty nests of the *Herons* in Wanstead Park, and although no decided increase of the *Kingfisher* is noted, several were seen, and they nested at Warlies and at Knighton. The number of *Wild Ducks* breeding at Wanstead has greatly increased.

The Epping Forest Committee and the Essex County Council have applied to the Home Secretary (as noted in our last number, vol. ix., p. 256) for an Order constituting the whole of the Forest parishes a protected area against the snaring and taking of birds by bird-catchers. It is to be hoped that this application will be granted.

The experiment of forming so large a "sanctuary" in a district embracing so much wooded ground, is one of a remarkable character, and the results will be watched with great interest by all naturalists.

Mr. Buxton appends to his report an appeal to the proprietors of land adjoining the forest to give all possible protection to the Roe Deer and Badgers. As they frequently wander into the adjoining plantations he hope that these gentlemen will combine with the Forest authorities to preserve these interesting species.

THE LIBRARY TABLE.

Round the Year: A series of Short Nature Studies. 1896.

The Natural History of Aquatic Insects. 1895. Both by Professor L. C. Miall, F.R.S.; with illustrations by A. R. Hammond, F.L.S. (Macmillan & Co., 6s. each).

THESE two books by Professor Miall are in our opinion of a very noteworthy character. They admirably illustrate the revulsion of opinion, daily gaining force, in favour of the view that the delightful observations and studies of the "Field Naturalist" are deserving of high esteem as educational agencies and as a means of enlarging and enobling the mind. The coming rejuvenescence of the fashion of the out-of-door study of nature, after decades of depreciation and neglect, is a very welcome sign of the times. The distinguished originator of the "type system" of teaching biology in our schools and colleges, is known to have regretted the extremes to which the curriculum had been carried, and the exclusion from it of any side lights which would lead the young beginner to feel that he was studying plants and creatures endowed with the glorious gift of life, and possessing a thousand individualities and relations to other living things in the air, the earth, and the waters under the earth. The teachers in our "Elementary Biology" classes behaved like the scene-shifters in the "Critic"—having been given a good thing, they never knew when to be done with it! Natural History, the delight and inspiration of White, Forbes, Darwin and Wallace, has in many schools become degraded to a mere art of skilful dissection and mechanical section-cutting, almost repulsive in its literalness, and often acting as a positive deterrent to the evolution of the budding biologist. Many a boy or girl has gone through such a course, and yet has been unable to recognise the commonest field weed, insect, or pond-creature, or sadder still has been led to look on biology as a somewhat repulsive "school subject," one bearing no relation to the intellectual pleasures of life, affording no fascinating recreation for leisure hours, no delightful solace for old age. The study of biology, the "science of *life*," was fast losing its highest value, and the "Field Naturalist" bade fair to become as extinct as the—pterodactyl.

But, as hinted above, there are already signs of more rational and suggestive views of the educational and pleasure-giving utility of biology again becoming prevalent, and many men of undoubted knowledge and experience have, in addresses to the British Association and elsewhere, pleaded well for the re-instatement of the Field Naturalist to a prominent place in the file of science workers. No one in his senses would wish to depreciate the valuable training afforded in the laboratory, or to undervalue the immense and far-reaching results of the modern biologist. All we plead for is a more catholic definition of biology, and the recognition of field-study, and above all of the observation of the living plant or animal, its mode of life, and relation to environment, as supplemental to and of equal importance with the use of the microscope and scapel. Professor Miall's works are valuable practical aids to the encouragement of such ideas. "Round the Year" is the more elementary book—its object is to lead people to *observe*, and to recognise the immense opportunities for pleasant and profitable study afforded by the familiar objects and phenomena of the open country. Professor Miall is no encourager of mere dilettantism. He shows how incumbent it is for the field naturalist to study his subject seriously from all sides if he wishes to appreciate the wonders that are presented in the structure and life-history of the commonest plant or animal—Goethe's words "Man sieht nur was man weiss" are his motto. The young naturalist who works through the year with Mr. Miall's book in hand, using it as a pleasant suggestor of lines of observation, will have gained much real knowledge of Natural History, and above all, will have received no inconsiderable training in that most difficult of all arts—the art of *seeing*.

The *Natural History of Aquatic Insects* is quite a unique book for the rational entomologist, who is tired of catching and setting out rows upon rows of beetles and butterflies, and ranging them in camphor-scented trays. The author seeks to lead naturalists "to lay aside their technical lists and records of parish distribution, and study the works of Nature with open eyes, seeking above all things to know more of life in its infinitely varied forms." In a dozen or more chapters teeming with suggestions for good practical work, he points the way to a *renaissance* of field natural history of the school of Swammerdam, Reaumur, Newport and Lubbock. With the advantage of some neighbouring ponds, a few simple aquaria and a good microscope (with ability to use it) the earnest student may readily follow out Professor Miall's "life-histories" and thereby gain more real knowledge of entomology than the perusal of a dozen of the ordinary books of the science, or the accumulation of thousands of specimens, would ever afford. The most valuable feature of the work is its suggestiveness.—Professor Miall points out how many interesting problems await solution, and the wide range of experimental observation necessary for their unravelment. Mere study of museum specimens will never do this; it is by observation of the living insects side by side by the employment of the methods of the practised dissector and microscopist, that progress will be made. There are wide fields open for exploration, and how pleasant are the paths! To use the words of Herbert Spencer equally applicable to the inland as to the marine naturalist "whoever at the sea-side has not had a microscope and an aquarium, has yet to learn what the highest pleasures of the sea-side are."

Mr. A. R. Hammond's skilful drawings, taken in most cases from life, add to the value of both books.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Number of the Deer in Epping Forest.—In the Report of the Epping Forest Committee presented to the Common Council on 14th January, 1897, the Committee state that "in the early part of last year we resolved that a census should be taken of the Deer. The difficulties of such an operation in a dense thicket are obvious, but out of four censuses, three were practically identical. An opportunity was found on the 30th of April last (1896). On the morning of that day there were counted 128 Fallow and 13 Roe Deer, and in the evening of the same day 131 Fallow and 9 Roe Deer.

"On the following day the experiment was repeated, when there were counted on the morning 133 Fallow and 12 Roe Deer, and in the evening 105 Fallow and 13 Roe. This census shows a large increase in the number of deer supposed to exist at the time of taking over the Forest."

The number of Fallow Deer above certified is satisfactory, and very creditable to the keepers, but we hoped to have heard of a greater increase of the Roe Deer. It will be remembered that the Roes were introduced into the Forest in 1884, mainly by the liberality and exertions of Mr. E. N. Buxton and Mr. J. E. Harting. The Deer were captured and brought from woods belonging to Mr. Mansell Pleydell and Mr. C. Hambro, in the Vale of Blackmoor in Dorsetshire, and on the morning of February 14th, 1884, two bucks and four does were set free near Monk Woods, Epping Forest (see full account by Mr. Harting in the ESSEX NATURALIST, vol. i., pp. 58-61). Since that date many taking quiet walks through the woods have been gladdened by the sight of these graceful little animals; we should have estimated the number at more than 13 –twelve years undisturbed (?) life in the woods should have shown a greater increase—but then we must remember that there are poachers!—ED.

"Beàting an Otter to death at Broxbourne on the Lea River."—The following letter in the *Standard*, signed "W. B. Harrison, King's Weir, Broxbourne," has formed the text of some vigorous outpourings on the merciless and cruel destruction of our Feræ Naturæ in the ignorantly imagined interests of a comparative small body of sportsmen:—"It may interest your fishing friends to know that on Tuesday [March 2nd, 1897] last a dog otter was caught in a trap close by here weighing twenty-one pounds, and measuring over four feet from head to tip of tail. It was only caught by the toe, and flew at the keeper like a dog; he was only armed with a stick, ***and it took him twenty minutes to kill it.***" [the italics are ours.] Comment is perhaps needless, but we shall take an early opportunity of putting on record the opinions of some of our best naturalist-sportsmen on the use of the steel-trap, surely one of the most cruel engines ever invented by man.—ED.

AVES.

Golden Orioles at Bowers Gifford in March. — General Branfill having kindly mentioned the occurrence of this bird, we wrote to the Rev. Henry Hasted, Rector of Pitsea, who courteously communicates the following particulars:—"I think that there is no doubt about the Oriole. It was seen in the grounds of Bowers Gifford Rectory by Miss Evelyn Williams, on Saturday, March 20th. She had a capital view of it both sitting and flying, and was about 15 yards from it. She describes it as a bright yellow bird, like a canary, only very much bigger—about the size of a thrush. I had heard that a strange bird had been seen near Bowers Gifford Rectory, and I had asked the Misses Williams to look out for it. To the best of my belief the female bird is or has been in this neighbourhood; it was seen distinctly by a woman in her garden some few days ago. She described it to me as a yellowish-greenish bird, about the size of a thrush or a blackbird. A good many years ago (I do not exactly remember the date, but it was about 1870) Golden Orioles were seen in the gardens of Bowers Gifford Rectory. There was no mistake about the fact, as a friend of mine, a great naturalist, saw one of them."

We need hardly point out that the above date is a very early one for the visit to our County of this beautiful bird. In the interesting account of the species in Christy's *Birds of Essex*, the earliest observation given is April 29th (with the exception of a somewhat doubtful record of November 20th, 1888), and the bird is usually seen about the middle of May. There is no reason why it should not breed in Essex, and we hope that Bowers Gifford Rectory garden will have the credit of sheltering a Golden Oriole's nest this spring.—ED.

Early Swallows.—Writing to us on March 26th, from Hazel Hall, Shere, Surrey, Mr. F. E. J. Blackburne said:—"About noon to-day I noticed a swallow hawking over the lake at Bury Hill, Dorking. I watched it for some time in order to make sure of it. On passing the same spot three hours later it was still there, and had been joined by two others. As this is an unusually early appearance, it may be of interest to your readers that it should be recorded." Since then Mr. W. Gibbs has informed us that he saw some swallows at Ryde on the 25th ult., and that on the 28th, when he wrote, they were fairly numerous. The Rev. D. R. Williams, Rector of Bowers Gifford, Pitsea, Essex, wrote yesterday that he had that morning seen a swallow hawking, although in his 70 years' observations he has never seen one in March before. "Here," he adds, "they usually appear about April 17th."—*Times*, April 1st, 1897.

Since the above appeared we hear that Mr. Parson, farmer, saw two swallows on March 29th, at Little Warley, Essex.

Merlin in Forest District.—In the report of the Epping Forest Bird Protection League, it is recorded under the heading "Loughton Hall" that a Merlin (*Falco æsalon*) had recently been seen in Loughton Shaws. As long ago as 1835 Edward Doubleday said of it that it was merely a visitor to Epping in the autumn months and that it was also very rare, but Mr. Hope reported in 1887 that it was not uncommon at Havering in the autumn. It is to be hoped that this most interesting bird may now be more frequently seen.

INSECTA.

LEPIDOPTERA.

Dark variety of Arctia caja at Shenfield.—Mr. R. G. Willament, of Brentwood, sends particulars of an interesting aberration of the Garden Tiger Moth (*Arctia caja*) which he has bred from a larva found on Shenfield Common in May, 1896. The moth is a female of normal size, but the fore-wings are dark brown, and the hind-wings blackish brown, with buff margins; the usual blue-black metallic spots being just visible through the dark ground colour. Melanic "sports" of this extremely variable insect seem to be of more frequent occurrence than the lighter varieties, but judging from the description, Mr. Willament's "Tiger" is a very fine example. It resembles one figured by Mr. C. G. Barrett on plate 71, vol. ii., in his magnificent work on the *Lepidoptera of the British Islands*, from Dr. Mason's collection, but the latter is a male. Almost all "varieties" of *A. caja* appear to be bred in confinement, and mainly from larvæ collected in Lancashire and Yorkshire.—ED.

BOTANY.

PHANEROGAMIA.

Epping Forest Plants.—Of the plants recorded as growing in Epping Forest there are in existence several lists, the most recent, I believe, being that published by Mr. J. T. Powell, in the ESSEX NATURALIST, in 1892. A copy of this list having recently come into my possession, I note that the following two plants are not recorded, nor are they given in the list of Epping Forest plants in Buxton's *Epping Forest*. They both probably have been seen by other observers than myself. *Stellaria umbrosa*, Opiz. in the forest, near Chingford; *Limnanthemum peltatum*, S. P. Gimel., pond south-west of Epping. The latter plant is given for Woodford (including the River Roding) in Cooper's *Flora Metropolitana*, 1836, upon the authority of Warner.—C. E. BRITTON, 189, Beresford Street, Camberwell, S.E., in *Science Gossip*, October, 1896.

PALÆONTOLOGY.

Gryphæa incurva, with Upper Valve in position.—In the course of some observations on this fossil in *The International Journal of Microscopy and Natural Science* for January, 1897, Mr. John French remarks that this species does not often occur as a perfect fossil:—"The geological range of these fossils is from the Lias to the Chalk (both inclusive) but so far as I know Liassic examples do not occur in Essex. Our derivatives, I believe, are principally from the Oolitic series (Oxford Clay, &c). The abrasion of the *Gryphæa*, for the most part, must have long anteceded the advent of the Boulder Clay, for most of the examples, broken from their matrix of hard rock, show considerable wear. It seems to be the fate of this shell generally to appear under this aspect, even in Liassic specimens. The amount of wear and tear and tossing about can also be inferred by another standard, and that is the general absence of the right or upper valve. Perhaps I should be within the truth if I said that not one specimen in a hundred bears this appendage. I could also safely say that not one specimen in a thousand (from the Essex Drift, at least) is a perfect fossil, but it has been my good fortune to meet with a few such examples, one of which was obtained from the Boulder Clay at Felstead. . . . . . . It is a much hardened form; every minute ridge and marking of the original shell is preserved in this specimen."

METEOROLOGY.

Extraordinary Rainfall in 1896 and 1897.—Mr. A. E. Watson, B.A., F.R., Met. Soc., writes on March 19th, giving the following figures of rainfall, as measured at the Whitgift Grammar School, Croydon, Surrey, which may be compared with those given for Lexden and Chelmsford by Mr. Hurnard and Mr. Chancellor in the last number of the E. N. (ix., p. 264):—August, 1896, 2·24 inches; September, 7·55; October, 3·59; November, 1·62; December, 3·49; January, 1897, 2·09: February, 2·15; March 1 to 18th, 3·42; total, 26·15.

The twenty-five years' average rainfall for Croydon is 26¼ inches; consequently Mr. Watson adds "we have had practically a year's rainfall in seven-and-a-half months, in addition to which September was the wettest month of which we have any record."

The writer of the Agricultural Notes in the *Standard* on March 23rd, 1897, remarks that it is "surely time for a settled improvement in climatic conditions, as we have experienced more than seven months of generally rainy or misty weather up to the 18th of March. A diary kept in a Middlesex district shows that in August, 1896, after the 8th, there were only two intervals of as much as two days and nights each free from rain and none in September. In October, there were three intervals of three to four days each; In November, three of four to eleven days; in December, one of eleven days; in January, 1897, four of two to six days; and in February four of two; and in March, only one of two days. But in these few and generally short intervals, for the most part, the atmosphere was misty, or the sky was overcast, and there was not a single whole week of fine and sunny weather during the period of more than seven months, while the rainfall as shown by a Croydon observer [Mr. Watson, quoted above] was only a small fraction of an inch below a whole year's normal quantity. There is too much reason to fear that the land has been drained of its nitrates to a serious extent during such an exceptionally wet season, and that the crops will suffer in consequence, unless the loss is covered by applications of artificial manure."

The Weather of 1896 from the Farmer's point of View.—Mr. Thomas B. Grubbe, of Ballast Quay Farm, Fingringhoe, has communicated to the *Essex Standard* the following interesting observations of the weather in his district:—"The year came in fair and mild, and we had but little frost during the first two months of the year, and less than an average rainfall. February was a particularly dry month, affording an opportunity for the early seeding of peas, beans, and oats, a good deal of barley being also put in. Rain came with March, and up till the middle of April the weather continued showery and unsettled, affording but scant chances of making good seed-beds for barley, and those who had sown in February had reason to congratulate themselves. From April 17th to June 9th was very dry, and light land crops suffered a good deal, but were relieved by a splendid ground rain on June 10, the date of our local Essex Show at Brentwood. This came rather late for the hay crops, which were not heavy, but were again of excellent quality, as in the previous year. Corn crops grew very rapidly after this rain, and made up to a good bulk, though a second drought set in at once, and lasted until August 9th, by which date the bulk of the corn in forward districts was safely in stack, the harvest being the earliest since 1868. The writer began cutting white oats on July 13th and wheat on July 14th, and carted his last load of corn on August 7th.

Root crops on light land suffered severely during the second half of July and first half of August, and grass feed became very scarce; but there was a great growth of Autumn grass, as a result of the September rains, which came very serviceable to live stock owners. The early sown roots also improved very much, and where a good plant had been secured made fair crops, but the season was unfavourable for late turnips, which are very scarce, and on many occupations flock-masters will be hard put to find feed for their sheep, if the early months of 1897 should bring a spell of severe weather.

The heavy rainfall of the Autumn interfered a good deal with the work on the land, neutralizing to a large extent the advantage gained by the early harvest, but November was a fairly dry month, enabling the arrears of wheat sowing to be overtaken, and the year goes out with open weather and farm-work generally fairly forward. The season, as a whole, may be put down as a distinctly good one for corn farmers, except on very light land, and with the improved prices recently obtained for wheat will certainly rank a-head of anything since 1892, and we can all devoutly hope that it may be the beginning of better times.

RAINFALL AND MEAN TEMPERATURE FOR 1896,

Taken at Fingringhoe, at 6 p.m., every day.

		Mean Temperature.		
	Rainfall.	Of maxim.	Of minim.	Average.
January	1·10	43·17	34·33	38·75
February	0·53	44·93	35·86	40·38
March	2·59	51·52	40·06	45·79
April	0·88	56·67	41·00	48·83
May	0·48	60·74	44·01	52·37
June	2·67	70·50	53·90	62·20
July	0·21	70·25	54·84	62·54
August	1·71	70·10	52·23	61·17
September	4·82	62·70	52·63	57·66
October	2·41	51·97	41·74	46·85
November	0·87	44·27	36·76	40·52
December	2·63	42·40	35·64	39·02

Total....... 20·90, comparing with 18·79 in 1895.

Highest shade temperature .. 82 deg. on July 9th.

Lowest ,, ,, .. 26 deg. on January 20th, February 26th and December 19th.

Lowest ,, ,, on grass 19 deg. on February 26th.

Greatest rainfall in 24 hours .. 1·47 on June 10th, and 1·12 on Sept. 1st.

NOTE.—The rainfall in many districts quite near by us was much heavier than it was here, particularly during August—some districts in the upper reaches of the Colne reporting between 3 and 4 inches in this month. Here we had no ground rain until September 1st, after June 10th."

MISCELLANEA.

Earthquake of December 17th, 1896, felt at Brentwood.—As I do not see any account of the Earthquake having been felt at Brentwood in the report in the last number of the ESSEX NATURALIST (vol. ix., pp. 258-9), I may say that at 5.30 a.m. on that day I was lying awake when I heard my jug rattle three or four times. There was then an interval of three or four seconds and the jug again rattled in a similar manner. I thought that my dog was in the room and was scratching himself against the wash-hand stand, so I at once lit my candle, but there was no dog. I then looked at my watch and saw it was 5.35. I felt no earthquake and but for the rattling of the crockery I should have known nothing about it. When I went down to breakfast in the morning, I jokingly remarked that the house must be haunted.—FRANK LANDON, The Red House, Brentwood, February 4th, 1897.

Agriculture in Essex.—The Royal Statistical Society held their fifth ordinary meeting of the Session at the Royal United Service Institution, Whitehall, on March 16th, when a paper on "Agriculture in Essex during the past 50 years, as exemplified by the records of one Farm, with special reference to the prices of Corn and the conditions of Labour," was read by Mr. Frederick C. Danvers. Mr. G. Shaw Lefevre, vice-president, occupied the chair. Mr. Danvers pointed out that this country now only produced sufficient home-grown wheat for two months' consumption of the population, and was, therefore, dependent upon foreign imports for the balance of its requirements. Reference was made to the general condition of Essex as regards wheat cultivation, and tables were given showing the corn and wheat areas in the country and on the particular farm dealt with in the paper. Whereas the wheat area in Essex had, since 1866, fallen by about 50 per cent., the wheat area on the farm had not perceptibly decreased; indeed, it had now five acres more under wheat than in 1866. One reason why the farm in question [? at Great Oakley] had been able to continue growing wheat had been its high producing powers; for, whereas the average yield of wheat for the whole country was but 28 bushels per acre, the yield on this farm had averaged 38½ bushels per acre. It was, however, shown that, taking the years when wheat was at its periodical highest price, the value of the crop on the farm fell from £20 3s. per acre in 1854 to £6 15s. in 1888—a price at which it would be impossible to grow wheat at a profit, even if the land were occupied rent free. With regard to the conditions of labour, it was shown that, whereas the total wage of a farm labourer amounted to 11s. 4d. a week in 1858, it now averaged as much as 15s. 8d. a week, with, in some cases, a rent-free cottage besides. Thus, notwithstanding the fall in value of all agricultural produce, the average yearly wages on this farm were now £157 more than formerly.—*Times*, March 18th, 1897.

"The Disappearance of certain species of Insects, with notes on their slaughter and protection."—Just as the present part goes to press, we have received an important paper, bearing the above title, from the author Mr. Frank Bouskell, F.E.S., which was read before the Leicester Literary and Philosophical Society in January last. Mr. Bouskell has collected startling evidence of the rapid disappearance by over-collecting of some of the most interesting native insects—evidence which demands the serious consideration of all right-thinking entomologists. It is proposed to bring the matter before a Meeting of the British Association. Prompt action seems to be necessary, and we shall return to the subject in our next part.—ED.

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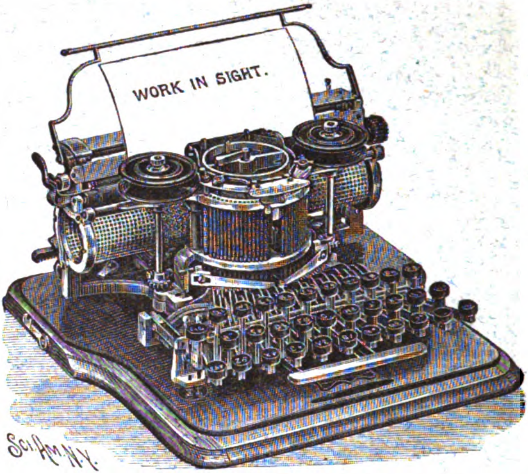
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EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary and Curator.

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Essex.

A few Advertisements can be inserted; for terms apply to the Editor.

The next Number will appear about October 15th.

THE NON-MARINE MOLLUSCS OF ESSEX.

By WILFRED MARK WEBB, F.L.S., Editor of the *Journal of Malacology*.

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Sub-Order II.—BASOMATOPHORA.

Family—AURICULIDAE.

Genus—CARYCHIUM, O. F. Müller, 1774.

Carychium minimum, Müller.

A.—Farnham; (Ingold): Epping; (Newstead): High Beach, Loughton; (C.S.R., Kew): Roding Meadows; Wanstead Park; (Crouch): Warley; (W.M.W.): *Ilford; (Woodward after Boyd Dawkins): Tilbury: (British Museum): Grays; (Woodward after Morris).*

B.—Barfield; (French): Coggeshall; (British Museum): Ingrave: Navestock; (W.M.W.): [*Felstead: (French)*]: **Copford; *Clacton; Witham; (British Museum): Shalford; (W.M.W.): Chignal; (Christy, S.): Roxwell; (R. Christy).*

C.—Saffron Walden; (S.W. Museum): Drift of the River Stour; (Christy): Ramsey; (Sheppard Collection): *Harwich; (British Museum).*

Genus—MELAMPUS, Montfort, 1810.

Melampus denticulatus, Montagu.

B.—River Colne, Wyvenhoe; (British Museum).

Genus—ALEXIA, Leach, 1847.

Alexia mysotis, Draparnaud.

A.—Grays; *Purfleet; (Jenkins).

C.—Dovercourt; (Adams).

Genus—LEUCONIA, Gray, 1840.

Leuconia bidentatus, Montagu.

B.—Brightlingsea; (W.M.W.).

C.—Dovercourt; (Adams).

Family—LIMNAEIDAE.

Genus—ANCYLUS, Geoffroy, 1767.

Ancylus fluviatilis, Müller.

A.—River Stort; (Ingold): River Roding; Wanstead Park; (Crouch): *Ilford; (Woodward after Boyd Dawkins): Canning Town; (K. and W.): Walthamstow; Docks: Grays: (British Museum).*

B.—River Chelmer, near Felstead; (French): *Kingsford; Stanway; (Laver): Frating; (British Museum): River at Faulkbourne; (Turner): River Cann, Chignal; (Christy): Chelmsford; (W.M.W.): *Copford: (British Museum): *Clacton; (Webb, 4).*

C.—Saffron Walden; (C.S.R., Ashford): Audley End; (Saffron Walden Museum): *River Stour; (King).

Ancylus lacustris, Linné.

A.—River Stort; (Ingold): Hatfield Forest; (E.N., vol. iv., p. 223): Wanstead Park; (Crouch): *Canning Town: Lea Valley; (K. and W.): Grays; (British Museum).*

B.—River Colne; (Laver): Little Tey; (Adams): River Chelmer; (E.N., vol. ii., p. 353): Great Baddow; (W.M.W.): Chelmsford; (Christy): *Copford;* (Laver): *Clacton; (K. and W. after S. V. Wood); Raine; (British Museum).*

C.—Saffron Walden; (C.S.R., Ashford): River Stour; (King): Wrabness and Ramsey; (Sheppard Coll.).

Genus LIMNAEA, Lamark, 1801.

Limnaea auricularia, Linné.

A.—River Stort; (Ingold): Hatfield Forest; (E.N., vol. iv., p. 223): High Beach, Loughton; (E.N, vol. vi., p. 73): River Lea, Chingford; (C.S.R., Scharff): *Ilford; (Woodward after Morris); Canning Town: (K. and W.): Walthamstow, Grays; (British Museum).*

B.—Beaumont; (Sheppard and Collection): River Colne—forms intermediate between this and *L. peregra*; (Laver): River Chelmer; (Christy). Broomfield; (E.N., vol. vii., [illegible]) Margaretting; (W.M.W.): [*Chelmer Valley—var.* [illegible] (Crouch)] **Clacton; (Webb, 4): Raine:* [illegible]

C.—Saffron Walden, (S.W. Museum): *River Stour; (Laver).

Limnaea pereger, Müller.

A.—River Stort; (Ingold): Hatfield Forest; (E.N., vol. iv., p. 223): *Epping Forest; Chingford; (C.S.R., Kew): Woodford; (E.N., vol. iii., p. 39): River Roding, Woodford; (Newstead): Wanstead; (Crouch): Leigh; (W.M.W.): *Canning Town; (K. and W.): Ilford; Walthamstow; Docks; Grays; Tilbury; West Thurrock; (British Museum).*

B.—Finchingfield; (Bailey): Sible Hedingham; Halstead; (Adams): Beaumont; (Sheppard Coll.): Felstead; (French): *Colchester, River Colne: Wyvenhoe Park—in almost salt water; (Laver): Walton; (C.S.R., Blatch): Kelvedon; Copford; (British Museum): Coggeshall; (Turner): Chignal—with a semi scalariforme individual; (Christy): River Chelmer and Beeleigh Mill; (E.N., vol. v., p. 233): Broomfield; (E.N., vol. vii., p. 76): Chelmsford; Ingrave; (W.M.W.): *Copford; (K. and W.): *Clacton; (British Museum): Chelmsford; (Webb, 5).*

C.—Saffron Walden; (S.W. Museum): Audley End Park; (C,S.R., Christy): Wrabness; Ramsey; (Sheppard): Dovercourt—in a brackish marsh; (Adams): *Harwich; (British Museum).*

Limnaea palustris, Müller.

A.—River Stort; (Ingold); Wanstead Park; (Newstead): Carswell; St. Swithin's; Whips Cross; (Crouch): *Canning Town; (K. and W.): Ilford; Walthamstow; (British Museum): Docks; (Woodward): Grays; West Thurrock; (British Museum).*

B.—Stebbing Brook, Felstead; River Chelmer, Felstead in flood *debris*—two shells described as follows: "In these the columellar (*sic*) of the last whorl is widely reflected and gaping, so that the interior of the shell may be seen from the anterior end" (E.N., vol. v., p. 181); (French): Coggeshall—some 1½ inches long; (Adams): *Colchester: Stanway; (Laver): Broomfield; (E.N., vol. vii., p. 76): Chelmsford; (Christy): *Copford; Clacton; (British Museum): Chelmsford; (Webb, 5).*

C.—In a pond, Wind Mill Hill, Saffron Walden, up to 1½ inches in length; (Christy): Saffron Walden; (S.W. Museum); *Harwich; (British Museum).*

Limnaea truncatula, Müller.

A.—River Stort; (Ingold): River Lea, Chingford; (C.S.R., Scharff); Carswell; St. Swithin's; (Crouch): *Canning Town; (K. and W.): Ilford; Walthamstow; (British Museum): Grays: (Woodward): Tilbury; (British Museum).*

B.—River Chelmer, Felstead; (French): Banks of the River Blackwater, Coggeshall; (British Museum): Colchester; Stanway; (Laver): Little Tey; (Adams): *Birch; (Laver Coll.): Copford; (British Museum): Witham; (Turner): Chignal—globose form; (Christy): River Chelmer; (E.N., vol. v., p. 353): Chelmsford; (Christy): *Felstead; (French): *Copford; Clacton; Witham; (British Museum): Chignal; (Christy, 3): Chelmsford; (Webb, 5).*

C. Saffron Walden; (S.W. Museum): Wrabness; (Sheppard and Collection); *Harwich; (K. and W. after S. P. Woodward).*

Limnaea stagnalis, Linné.

A.—River Stort; (Ingold): Hatfield Forest; (E.N., vol. iv., p. 223); Epping Forest; (Cole): Walthamstow; Chingford; (C.S.R., Kew): Woodford; (E.N., vol. iii., p. 39); Whips Cross; Barking Side; Wanstead Park; (Crouch): Leytonstone; (Newstead): Purfleet—and white variation; (Jenkins): *Ilford; Canning Town; (K. and W.): Walthamstow; British Museum; Grays; (Woodward after S. V. Wood).*

B. River Colne, Halstead; (Adams): Felstead; (French): Little Tey; (Adams): Coggeshall; (British Museum): Colchester District; Langenhoe; (Laver): Dunmow; (Christy): Chipping Hill, Witham; (Turner): Chignal; (Christy): Broomfield—globose form; Chelmsford; (W.M.W.): *Copford; Raine; (British Museum): Clacton; (K. and W.).*

C. Saffron Walden; Wimbish Hall—fine specimens; (S.W. Museum): River Stour; Wormingford—two inches long, in ponds; (Laver).

Limnaea glabra, Müller.

A. Woodford; (E.N., vol. iii., p. 39): St. Swithin's Farm, Barking Side—one shell; (Crouch).

B. Donyland Wood, Colchester; (Laver).

Z. Saffron Walden; (S.W. Museum). The specimens in Saffron Walden Museum are young *L. peregra*.—W.M.W.

Z. *Limnaea involuta*, Harvey. The only locality is in Ireland.

Genus—PLANORBIS, Guettard, 1756.

Planorbis corneus, Linné.

A.—River Stort ; (Ingold) ; Hatfield Forest ; (E.N., vol. iv., p. 223) ; Barking Side ; Wanstead ; East Ham ; Leyton ; Whips Cross ; (Crouch) : Walthamstow : (C.S.R., Kew) : Leytonstone ; (Newstead) : *Ilford ; (Woodward after Morris) : Canning Town ; (K. and W.) : Walthamstow ; (British Museum) : Grays ; (Woodward after S. V. Wood), West Thurrock ; (Woodward).*

B.—Coggeshall ; (British Museum) : *Colchester ; (Laver) : *East Mersea ; (Cole) : River Chelmer and Beeleigh Mill) ; (E.N., vol. v., p. 253) ; Broomfield ; (E.N., vol. vii., p. 76) : Chelmsford ; (Turner) ; *Clacton ; (K. and W. after S. V. Wood).*

C.—Saffron Walden ; (S.W. Museum).

Planorbis albus, Müller.

A.—River Stort ; (Ingold) : Epping ; (Newstead) : Chingford ; (C.S.R., Kew) : Woodford ; (E.N., vol. iii., p. 39) ; St. Swithin's ; (Crouch) : *Ilford ; (Woodward) : Canning Town ; (K. and W.) : Walthamstow ; (British Museum) : Grays ; (Woodward).*

B.—River Chelmer, Felstead ; (French) : River Blackwater, Coggeshall ; (British Museum) : Donyland Heath ; (Laver Coll.) : Colchester : Wyvenhoe Park—in brackish water ; (Laver) : River Chelmer and Beeleigh Mill ; (E.N., vol. v., p. 253) : Broomfield ; (E.N., vol. vii., p. 76) : Chelmsford : (Christy) : Ingrave ; (W.M.W.) : *Braintree ; Copford ; (British Museum) : Clacton ; ([illegible] 4) ; Chignal ; (Christy 3)*

C.—*Harwich ; (K. and W.).*

Planorbis glaber, Jeffreys.

A.—Carswell Pond—one specimen ; (Crouch) : Dagenham ; (British Museum) : *Ilford ; (K. and W.) : Grays ; (Woodward after S. V. Wood).*

B.—*Clacton ; (K. and W.) : Rainham ; [illegible]*

Planorbis nautileus, Linné.

A.—Barking Side ; (Crouch) : *Canning Town ; (K. and W.) : Walthamstow ; (British Museum) : Grays ; (Woodward after S. V. Wood).*

B.—Coggeshall ; (British Museum) : Colchester ; [illegible] : West Bergholt ; (Laver) : Chignal ; (C.S.R., Christy) : Chelmsford; (Christy): Margaretting; (W.M.W.): *Clacton*: (*K. and W.*): *Shalford*; (*W.M.W.*): *Copford*; *Braintree*; *Raine*; (*British Museum*).

C.—Saffron Walden; (S.W. Museum): Wrabness; (Sheppard and Collection).

Planorbis carinatus, Müller.

A.—River Stort; (Ingold): River Lea, Chingford; (C.S.R., Kew): River Roding, Woodford; (C.S.R., Oldham): Walthamstow: (C.S.R., Kew): Wanstead Park; (Newstead): St. Swithin's Farm: Whips Cross; River Lea; (Crouch): *Lea Valley*; *Ilford*: (*K. and W.*); *Grays* (*K. and W. after J. Morris*).

B.—River Colne; (Halstead): Stebbing Brook, Felstead: (French): River Blackwater; (British Museum): *Colchester; *Ardleigh Crown; (Laver): River Chelmer; Beeleigh Mill; (E.N., vol. v., p. 253): Broomfield; (E.N., vol. vii., p. 76); *Clacton* (*K. and W.*).

C.—Saffron Walden; (S.W. Museum): Audley End Park; (C.S.R., Christy): Ramsey Stream; (Sheppard): Wrabness; (Sheppard Collection): Dovercourt—in a brackish marsh; (Adams).

Planorbis marginatus, Draparnaud.

A.—River Stort; (Ingold): Chingford; (C.S.R., Kew): Woodford; (E.N., vol. iii., p. 39): Barking Side; Whips Cross; River Lea; River Roding; (Crouch): Tilbury Marsh; (Jenkins): *Canning Town*; (*K. and W.*): *Ilford*; *Walthamstow*; (*British Museum*): *Docks*; (*Woodwards*): *Grays*; *West Thurrock*; (*British Museum*).

B.—River Chelmer, Felstead; (French): Coggeshall; (Turner): Colchester; (Laver): Chignal; (C.S.R., Christy): River Chelmer; (E.N., vol. v., p. 253): Chelmsford; (C.S.R., Ashford): *Copford*; *Raine*; (*British Museum*): *Clacton* (*K. and W. after J. Brown*): *Chelmsford*; (*Webb*, 5).

C.—Saffron Walden; (S.W. Museum): Audley End Park; (C.S.R., Christy): Wrabness; (Sheppard Collection): Dovercourt—in a brackish marsh; (Adams).

Planorbis vortex, Linné.

A.—River Stort; (Ingold): Epping; River Roding, Woodford; (Newstead): Chingford; (C.S.R., Scharff): Wanstead; Walthamstow; Barking Side; (Crouch): Tilbury Marsh; (Jenkins): *Ilford*; (*K. and W.*): *Walthamstow*; (*British Museum*).

B.—River Colne, Halstead; (Adams): River Chelmer, Felstead; (French): Coggeshall—large striated variation; (British Museum): Coggeshall Abbey; (Turner): *Colchester; (Laver): River Chelmer and Beeleigh Mill: (E.N., vol. v., p. 253): Broomfield; (E.N., vol. vii., p. 76): Chelmsford; (C.S.R., Ashford): *Copford*; *(British Museum)*; *Clacton (K. and W. after S. P. Woodward)*.

C.—Saffron Walden; (S.W. Museum): Dovercourt—in a brackish marsh; (Adams).

Planorbis spirorbis, Linné.

A.—River Stort; (Ingold): Elsenham; (Hughes): Wanstead; Walthamstow; Barking Side; (Crouch): *Tilbury Marsh; (Jenkins Coll.): *Ilford; Canning Town; (K. and W.)*: *Walthamstow; (British Museum): Grays; West Thurrock; (British Museum)*.

B.—Coggeshall Abbey; (Turner): Little Tey; (Adams): *Colchester; (Laver): South Weald; (C.S.R., Christy): *Braintree; (K. and W.)*: *Copford; Raine; Witham; (British Museum): Clacton (K. and W.)*: *Braintree; (K. and W.)*: *Shalford; (W.M.W.)*: *Chignal; (Christy, 5)*: *Roxwell; (R. Christy)*: *Chelmsford; (Webb, 5)*.

C.—Saffron Walden; (S.W. Museum): Wrabness; (Sheppard and Collection): Ramsey; (Sheppard Collection): Dovercourt—in a brackish marsh; (Adams).

Planorbis contortus, Linné

A.—River Stort; (Ingold): Hatfield; (Hughes): Wanstead: Barking Side; East Ham: River Roding; (Crouch): *Thurrock Marsh; Tilbury Marsh; (Jenkins [illegible]): *Canning Town; (K. and W.)*: [illegible] *Museum)*: *Grays; (Woodward after S. P. W[illegible]*

B.—River Chelmer, Felstead; (French): Co[illegible] (British Museum): *Colchester; (Laver): Chignal [illegible] (C.S.R., Christy): River Chelmer, Chelmsford; (Christy): *Copford; Raine; (British Museum)* [illegible]

C.—Saffron Walden; (S.W. Museum

Planorbis fontanus, Lightfoot [illegible]

A.—Bishop's Stortford; (Hughes) [illegible]

B.—†Felstead; (C.S.R., French [illegible] *orbis nitidus* is recorded, but it was afterwards struck out): Coggeshall; (British Museum): *West Bergholt: (Laver Coll.): Colchester; (Laver): Chignal; (Christy): Chelmsford; (C.S.R., Ashford): *Copford; Raine; (British Museum); Clacton; (K. and W.)*.

C.—Saffron Walden; (C.S.R., Ashford): Ramsey Decoy Pond; (Sheppard and Collection).

Planorbis lineatus, Walker (=*nitidus*, Müller in part).

A.—Hatfield; (Hughes): River Roding; (Crouch): *Ilford: (British Museum): Grays; (Woodward after S. V. Wood)*.

B.—*Clacton; (K. and W.)*.

C.—River Stour; (Laver has seen shells from this river).

Family—PHYSIDAE.

Genus—**PHYSA,** Draparnaud, 1801.

Physa fontinalis, Linné.

A.—Bishop's Stortford; (Ingold): Hatfield Forest; (E.N., vol. iv., p. 223): Wanstead Park; River Roding: Abridge; (Newstead): Fern Hall; Whip's Cross; (Crouch): *Canning Town; (K. and W.): Walthamstow; (British Museum)*.

B.—River Colne, Halstead; (Adams): Pond in Park Meadows, Felstead; (French): Coggeshall; (Turner): Colchester: (British Museum and Laver): Witham: (Turner): River Chelmer and Beeleigh Mill: (E.N., vol. v., p. 253): River Cann, Chelmsford; (W.M.W.). (*The specimens from Chignal were Physa hypnorum.—W.M.W.*): *Clacton*. (*K. and W.*).

C.—Saffron Walden, (S.W. Museum).

Physa hypnorum, Linné.

A.—Given by Ingold for Bishop's Stortford, but not taken by Hughes. Barking Side; (Crouch): *Lea Valley: (K. and W.)*.

B.—Mill Lands Brook, Felstead; (French): Little Tey; (Adams): Colchester; (Laver): Frating; (British Museum): Chignal; (Christy): *Copford; (British Museum): S[illegible]; (W.M.W.): *Chignal; (Christy): [illegible]; (K. and W.)*.

C.—Walden and Ramsey; (Sheppard Collection).

Order—PROSOBRANCHIATA.

Sub-order—MONOTOCARDIA.

(A) *TAENIOGLOSSA*

Family—Hydrobiidae.

Genus—PALUDESTRINA, D'Orbigny, 1840.

Paludestrina confusa, Frauenfeld (=*Hydrobia* and *Bythinia similis*, Draparnaud).

A.—Becton; (Jenkins).

Paludestrina jenkinsi, Smith.

A.—Becton; (figured E.N., vol. iv., p. 213): Becton; Coldharbour Point; (Jenkins): *Rainham; (Jenkins' Coll.): Tilbury; (Horsley).

Paludestrina ventrosa, Montagu.

A.—Coldharbour Point to Tilbury Fort; West Tilbury; (Jenkins): Thurrock Marsh; (Jenkins Coll.): Tilbury; (Horsley): *Grays*; *Tilbury*; (*British Museum*).

B.—Between Walton and Thorpe-le-Soken; (specimens collected by J. C. Shenstone—W.M.W.): St. Osyth; (E.N., vol. v., p. 259); **Clacton*; *Witham*; (*British Museum*).

C.—Saffron Walden; (S.W. Museum): *Harwich*; *British Museum*).

Paludestrina stagnalis, Baster (=*ulvae*, Pennant).

A.—Grays; Tilbury; (Jenkins).

B.—Wyvenhoe; (British Museum): *Colchester; (Laver Coll.); *Clacton*; (*K. and W.*).

Paludestrina marginata, Michaud. Extinct in Britain.

A.—*Grays*; (*British Museum*).

B.—*Copford*; (*British Museum*): *Clacton*; (*W*[illegible]

Genus—BYTHINIA, Gray, 1821.

Bythinia tentaculata, Linne.

A.—River Stort; (Ingold): River Lea, Chingford; (C.S.R., Scharff): River Roding, Woodford; (C.S.R., Oldham): Wanstead; Fern Hall, [illegible]; [illegible]: Roding Meadows; St. Swithin's Farm; [illegible] Marsh—and white variety; (Jenkins): [illegible]: (*K. and W.*): *Ilford*; [illegible] Museum);

Docks; *Grays*; *West Thurrock*; (*British Museum*).

B.—Finchingfield; (Bailey): River Colne, Halstead: (Adams): River Chelmer, Felstead; (French): Coggeshall; (British Museum): *Colchester; (Laver): Witham; (Turner): River Chelmer and Beeleigh Mill; (E.N., vol. v., p. 253): Chelmsford; (Christy): River Cann; (W.M.W.): Ponds, Broomfield; (E.N., vol. vii., p. 76): *Raine*; *Braintree*; *Copford*; **Clacton*; (*British Museum*): *Chignal*; (*Christy, 3*).

C.—Saffron Walden; (S.W. Museum): *Harwich—opercula only*; (*British Museum*).

Bythinia leachii, Sheppard. The type is in the Sheppard Collection.

A.—River Stort; (Ingold): Fern Hall; St. Swithin's; (Crouch): Coldharbour Marsh; (Jenkins): Tilbury Marsh; (Jenkins Coll.): *Ilford*; (*Woodward*): *Walthamstow*; (*British Museum*): *Grays* (*K. and W.*).

B.—River Colne, Halstead, (Adams): River Chelmer, Felstead; (French): Coggeshall; (British Museum): Colchester; (Laver): River Chelmer, Broomfield; (Christy): Chelmsford: (W.M.W.).

C.—Saffron Walden; (S.W. Museum); *Harwich* (*K. and W. after S. P. Woodward*).

Family—VIVIPARIDAE.

Genus—**VIVIPARA**, Montfort, 1810 (=*Paludina*, Lamark).

Vivipara contecta, Millet.

A. [Recorded in error, Ingold, for Bishop's Stortford District. Old River Lea; (Laver Collection): *Lea Valley*; (*K. and W.*).

B. Colchester: (Laver Collection).

C. River Stour; (Laver).

Vivipara vivipara, Linné.

A. River Stort; (Ingold): Roydon; (Laver Coll.): River Lea, Chingford; (C.S.R., Scharff): River Roding, Woodford Bridge to Red Bridge, Wanstead, (Crouch): *Canning Town*; *Lea Valley*; (*K. and W.*).

C.—Saffron Walden; (S.W. Museum): River Stour; (King).

Family—VALVATIDAE.

Genus—**VALVATA**, O. F. Müller, 1774.

Valvata piscinalis, Müller.

A.—Bishop's Stortford; (Ingold): River Lea, Chingford; (C.S.R., Scharff): Fern Hall; St. Swithin's; (Crouch): Leytonstone; (Newstead): *Ilford*; (*Woodward*): *Canning Town*; (*K. and W.*): *Walthamstow*; (*British Museum*): *Docks*: (*Woodward*): *Grays—with variation called antiqua*; (*British Museum*).

B.—River Colne, Halstead; (Adams): River Chelmer, Felstead; (French): Coggeshall; (Turner): *Colchester; (Laver): Witham; (Turner): Chignal; (C.S.R., Christy): Rivers Chelmer and Cann, Chelmsford; (Christy): *Copford*; *Braintree*; **Clacton*; *Kelvedon*; *Witham*; (*British Museum*): **Chignal*; (*Christy*, *3*).

C.—Saffron Walden; (S.W. Museum): Audley End Park; (C.S.R., Christy): *Harwich*: (*K. and W.*).

Valvata cristata, Müller.

A.—Hatfield Heath; (Hughes): St. Swithin's; Barking Side; (Crouch): Lea Marshes; (C.S.R., Rowe): Dagenham; (C.S.R., British Museum—mixed with *Planorbis glaber*): *Walthamstow*; (*British Museum*): *Ilford*; *Canning Town*; (*K. and W.*): *Grays*; (*British Museum*).

B.—River Chelmer, Felstead; (French): *Coggeshall; (British Museum): Colchester; (Laver): Chelmsford; (Christy): River Cann, Chelmsford; River Chelmer, Broomfield; (W.M.W.): *Clacton*; *Copford*; (*K. and W.*): *Raine*: *Braintree*; (*British Museum*): *Chignal*; (*Christy*, *3*).

C.—Saffron Walden; (S.W. Museum): Ramsey; (Sheppard Collection).

Family—ASSIMINEIDAE.

Genus—**ASSIMINEA**, Leach, 1828

Assiminea grayana, Leach.

A.—Grays; (Christy); Between Coldharbour Point and Purfleet; Grays; (Jenkins [illegible]): Tilbury Marsh; (Jenkins Coll.).

B.—†River Colne, Colchester; (British Museum): Tollesbury; (?).

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§ Put down as a pulmonate, which [illegible] W.M.W.

Family—CYCLOSTOMATIDAE.

Genus—**POMATIAS**, Studer, 1789 (=*Cyclostoma*, Draparnaud).

Pomatias elegans, Müller.

B.—Felstead, 1890, in an area less than 100 yards wide at its greatest diameter; (French, E.N., vol. iv., pp. 92-94): Coggeshall; (?): **Felstead*; (*French*): *Witham*; (*British Museum*): *Shalford*; (*W.M.W.*): **Chignal*; (*Christy, 3*): *Roxwell*; (*R. Christy*).

C.—Saffron Walden—dead shells; (Christy): Wicken Bonhunt; (S.W. Museum): Belchamp; (King): [*Mount Bures*; (*C.S.R., Crowther*).]

Family—ACICULIDAE.

Genus—**ACICULA**, Hartmann, 1821.

[**Acicula lineata**, Draparnaud.]

B.—*Felstead*; (*French*)]: **Copford*; (*British Museum*): *Shalford*; (*W.M.W.*): *Chignal*; *Christy, 3*); *Roxwell*; (*R. Christy*).

Sub-order—**DIOTOCARDIA**.

(A) *AZYGOBRANCHIA*.

Family—NERITIDAE.

Genus—**NERITINA**, Lamark, 1809.

Neritina fluviatilis, Linne.

A.—River Lea, Chingford; (C.S.R., Scharff): *Old River Lea; (Cole): River Roding; Crooked Meadow; St. Swithin's Farm; Wanstead Park; River Lea; (Crouch): *Canning Town*; (*K. and W.*): *Walthamstow*; (*British Museum*): *Docks*; *British Museum*).

B.—Coggeshall; (British Museum): Colchester; (Laver): River Chelmer; (E.N., vol. v., p. 253): Broomfield; (E.N., vol. vii., p. 70): *Felstead—in alluvium*; (*French*).

C.—River Stour; (King).

Class—PELECYPODA.

Order—EULAMELLIBRANCHIA.

Sub-order—SUBMYTILACEA.

Family—DREISSENSIIDAE.

Genus—**DREISSENSIA**, Van Beneden, 1835 (emended by Fischer, 1886).

[*Dreissensia polymorpha*, Pallas.]

Family—UNIONIDAE.

Genus—**UNIO**, Retzius, 1788.

[**Unio littoralis**, Lamark.] Extinct in Britain.

A.—*Grays*; (*British Museum*).
B.—**Clacton*; (*British Museum*).

Unio pictorum, Linné.

A.—River Stort; (Ingold): Hatfield Forest; (Hughes); —4½ inches long; (Christy): River Roding; Old Mill to Wanstead Park; (Crouch): *Walthamstow*; (*British Museum*); *Grays*; *Ilford*; (*K. and W.*).

B.—River Chelmer, Felstead; (French): Coggeshall; (Laver, saw specimens from here—Turner): Brook at Tilty; Dunmow; River Cann, Chignal; River Chelmer—very green; (Christy): Broomfield; (E.N., vol. vii., p. 76).

Unio tumidus, Retz.

A.—Hatfield Forest; (Ingold): River Roding, Old Mill to Wanstead Park; (Crouch): *Ilford*; *Walthamstow*; (*British Museum*): *Docks*; *Grays*; (*British Museum*).

[*Unio margaritifer*, Linné.]

Genus—**ANODONTA**, Lamark, 1799.

Anodonta cygnaea, Linné.

A.—River Stort—with form *anatina*; (Ingold): Old River Lea; (Cole): Hatfield Forest (Hughes and E.N., vol. iv., p. 223): Wanstead Basin; Eagle Pond, Snaresbrook; Walthamstow; River Lea—*anatina* form; River Roding, Wanstead; (Crouch): *Ilford*; (*K. and W.*): *Lea Valley*; (*K. and W.*): *Grays*; (*British Museum*).

B.—Finchingfield; (Bailey): River Colne, Halstead—with *anatina* form; (Adams): River Chelmer, Felstead; (French): River Blackwater, Coggeshall; (Turner): Colchester—with *anatina* form; (Laver, who thinks *anatina* to be a variation, and suggests experiments): Markshall—and *anatina* form; (Turner): River Chelmer; (E.N., vol. v., p. 253): Broomfield; (E.N., vol. vii, p. 76); River Cann, Chignal; River Chelmer, Chelmsford; Skreens Park, Widford Lake; (Christy): River Wid, Widford; (W.M.W): Navestock Park—truncated form and specimens 6¾ inches long; (Christy): *Clacton*; (*K. and W.*).

C.—Saffron Walden; (S.W. Museum): Moat at Wimbish Hall; (Christy): *River Stour; (Laver Coll.).

Family—CYRENIDAE.

Genus—**CORBICULA**, Megerle von Mühlfeldt, 1861.

Corbicula fluminalis, Müller. Extinct in Britain.

A.—*Ilford*; *Grays*; (*British Museum*).

B.—*Clacton* (*K. and W. after S. V. Wood*).

Genus—**SPHAERIUM**, Scopoli, 1777.

Sphaerium rivicola, Leach.

A.—River Stort; (Ingold).

Sphaerium corneum, Linné.

A.—River Stort; (Ingold): Hatfield Forest; (E.N., vol. iv., p. 223): River Roding, Abridge; (Newstead): River Lea, Chingford; (C.S.R., Scharff): River Roding, Woodford; (C.S.R., Oldham): Barking Side; Wanstead; Leytonstone; Whips Cross; Walthamstow; East Ham; (Crouch): *Tilbury Marshes; (Jenkins): *Canning Town*; (*K. and W.*): *Ilford*; (*Woodward after Dawkins*): *Walthamstow*; (*British Museum*): *Docks*: *Grays*; *Tilbury*; (*British Museum*).

B.—Finchingfield; (Bailey): River Colne, Halstead; (Adams): Beaumont; (Sheppard Collection): River Chelmer, Felstead; (French): Coggeshall; (British Museum): Kelvedon; ([illegible]): Little Tey; (Adams); Colchester; (Laver): River Chelmer; (E.N., vol. v., p. 253): Broomfield; (E.N., vol. vii., p. 76): Chelmsford—yellow variation; (Christy): River Cann, Chelmsford; (W.M.W.): *Clacton*; (*K. and W.*): *Witham*; (*British Museum*). ‡*Chignal recorded, but no specimens in Christy Coll.*

C.—Saffron Walden; (S.W. Museum): Wrabness; (Sheppard and Collection).

Sphaerium ovale, Férussac.

A.—Woodford; (E.N., vol. iii., p. 39, Sauzé).

Sphaerium lacustre, Müller.

A.—Tilbury Marshes; (Jenkins).

B.—Finchingfield; (Bailey): Little Tey; (Adams); Colchester; (British Museum and Laver): Ardleigh Wick; (Laver Coll.): Chelmsford; (Christy).

C.—Saffron Walden; (S.W. Museum).

Genus—PISIDIUM, C. Pfeiffer, 1821.

Pisidium amnicum, Müller.

A.—River Stort; (Ingold): River Roding, Woodford; C.S.R., Oldham): Fern Hall; Barking Side; Wanstead Basin; (Crouch): *Canning Town*; (*K. and W.*): *Ilford*; *Walthamstow*: *Docks*; *Grays*; (*British Museum*).

B.—Halstead; (Adams): Finchingfield; (Bailey): River Chelmer, Felstead; (French): Coggeshall; (British Museum): Colchester; (Laver): River Chelmer and Beeleigh Mill; (E.N., vol. v., p. 252): Broomfield; (E.N., vol. vii., p. 76): River Cann, Chelmsford; (W.M.W.): **Clacton*; (*British Museum*).

C.—Saffron Walden; (S.W. Museum): Ramsey; Wrabness; (Sheppard Collection).

Pisidium astartoides, Sandberger. Extinct in Britain.

A.—*Ilford*; (*K. and W.*): *Grays*; (*British Museum*).

B.—**Clacton*; (*British Museum*).

Pisidium pusillum, Gmelin.

A.—Fern Hall; (Crouch): *Ilford*; *Canning Town*: *Lea Valley*; (*K. and W.*): *Grays*; (*Woodward after S. V. Wood*).

B.—River Chelmer, Felstead; (French): Coggeshall; (British Museum): Colchester; (Laver): *Felstead*; *French*: *Copford*; (*British Museum*): *Clacton*; (*K. and W. after J. Brown*): *Shalford*; (*W.M.W.*) [illegible]; (*Christy, 3, recorded as P.* [illegible]).

C.—Saffron Walden; (S.W. Museum): River Stour, [illegible]: *Harwich* (*K. and W. after G. P.* [illegible]).

Pisidium nitidum, Jenyns.

B.—Colchester; (Laver): ‡[illegible].

Pisidium fontinale, Draparnaud.

A.—River Stort; (Ingold): *Canning Town*; (*K. and W.*): *Ilford*; *Walthamstow*; (*British Museum*): *Docks*; *Grays*; (*British Museum*).

B.—River Chelmer, Felstead; (French): *River Colne, near Colchester; (Laver): River Cann, Chelmsford; (W.M.W.): [*Felstead*; (*French*)]: *Raine*; *Copford*; *Clacton*; *Braintree*; (*British Museum*): **Chignal*; (*Christy, 3*).

C.—River Stour; (King).

Pisidium milium, Held (=*roseum*, Scholtz).

A.—Lea Marshes; (E. H. Row, *Naturalist's World*, 1885).

SUMMARY.

It will be seen from the from the foregoing list that, taken as a whole, the recent molluscan fauna of Essex is rich in number of species. The shells of many species also which have not been recorded as living in the County, but which have not yet disappeared from the British Isles, are to be found fossil in the various Post-pliocene deposits that are a feature of Essex. Again, in these same deposits, six out of the seven extinct British species have been discovered; that is all except *Clausilia pumila.*

It is probable that several species not hitherto recorded for Essex will, from time to time, be added to the list, and that further work will show a more general distribution of some forms over the County. The Slugs still require a considerable amount of attention, while little collecting has been done in several large districts. A general discussion on distribution or a comparison of the past and present faunas can hardly be entered upon here, and may form the subject of a future paper. For notes on some of the individual species the reader is referred to Messrs. Kennard and Woodward's paper "On the Post-Pliocene Non-Marine Mollusca of Essex" in the present number of the ESSEX NATURALIST; while a brief statement as to the number of forms not found living or fossil (as the case may be) is appended to the table which accompanies the last mentioned paper.

In the following table § the number of species occurring in the various provinces and the whole county are compared with one another and with the general list for the British Isles:—

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§ The additions are included: two species (*Oncidiella celtica* and *Azeca elongata*) having been considered as British, make the apparent discrepancy between the 138 species given by Messrs. Woodward and Kennard for the British Isles and the 140 set down in the table.

CLASS or ORDER.	ESSEX.												BRITISH ISLES.	
	Province A.			Province B.			Province C.			The whole County.				
	Living.	Fossil only.	Extinct in Britain.	Living.	Fossil only.	Extinct in Britain.	Living.	Fossil only.	Extinct in Britain.	Living.	Fossil only.	Extinct in Britain.	Living.	Extinct.
STYLOMATOPHORA ..	52	4	1	51	12	1	43	1	0	60	7	2	85	3
BASOMATOPHORA ..	23	0	0	23	2	0	21	1	0	25	0	0	27	0
PROSBRANCHIATA ..	12	0	1	10	1	1	9	0	0	13	2	1	14	1
PELECYPODA	11	0	3	8	0	3	6	0	0	12	0	3	14	3
TOTALS ..	98	4	5	92	15	5	79	2	0	110	9	6	140	7
GRAND TOTALS ..	102		5	107		5	81		0	119		6	140	7
	107			112			81			125			147	

Additions.

[**Vertigo minutissima**, Hartmann.] *Clacton*; (*K. and W*, *after S. V. Wood*).

[**Vertigo alpestris**, Alder.] *Chignal*; (*in Christy Collection*, *W.M.W.*).

The following localities for fossils should be added for the species given after them. The records are on the authority of Messrs. Woodward and Kennard—if not marked otherwise, § signifies S. V. Wood, † S. P. Woodward :—

Ilford: *Pyramidula ruderata* (*after J. G. Jeffreys*); *Succinea oblonga* (*after Morris*).

Grays: *Punctum pygmaeum* §; *Pyramidula rotundata* §.

Clacton: *Vitrea crystallina*, *V. cellaria* §, *V. pura* §, *V. excavata*, *V. nitida* §, *V. fulva*; *Pyramidula ruderata*; *Acanthinula aculeata*; *Helicigona lapicida*; *Buliminus montanus*; *Pupa cylindracea* §; *Vertigo minutissima*, *V. antivertigo* §, *V. pygmaea* §, *V. pusilla* §; *Clausilia laminata*; *Cochlicopa lubrica*; *Azeca tridens*; *Succinea putris*, *S. oblonga*.

Witham: *Vertigo pygmaea* †.

Chignal: *Vertigo alpestris*; (*W.M.W.*).

Harwich: *Vitrea cellaria* †; *Pyramidula rotundata* †; *Acanthinula aculeata* †; *Vertigo substriata* †; *Clausilia bidentata* †.

Corrections.

In the earlier part of the paper "*Crossness*" is erroneously given as an Essex locality.

PAGE 34, line 2. Under **Vitrea nitidula** "*Ilford*" should be omitted.

PAGE 41, line 8. Before "*Chignal*" insert "*: Shalford*; (*W.M.W.*)."

PAGE 43, line 27. For "*Copford*" read "*Clacton*."

PAGE 45, line 31. **Vertigo angustior** was accidentally omitted from the printed "Walton" (i.e. *Clacton*) list (Webb, 4), but shells of this species are in the collection and the writer's manuscript list.

PAGE 45, last line but one. Under **Balea perversa** omit "*Grays*."

PAGE 45, line 26. Insert *Tilbury*; (*K. and W.*).

PAGE 46, line 35. Omit "*Witham*."

PAGE 46, line 37. Omit "*Crayford*."

PAGE 47, line 30. After "**CAECILIANELLA**" read "Bourguinat, 1856."

PRESIDENTIAL ADDRESS,

DELIVERED AT THE ANNUAL MEETING, MARCH 27th, 1897,

By DAVID HOWARD, J.P., F.C.S.

[*Abstract.*]

PERHAPS it may be excused in one who has known and loved Epping Forest so long as I have, to mention it yet again, and to call attention to the remarkable instance of the recuperative powers of nature shown in the past year in the growth of our woodlands.

In the early summer nothing could exceed the desolation of a large portion of the forest. Swarms of caterpillars had eaten every leaf of the hornbeams and oaks in considerable tracts of woodland, and it was difficult to see how such desolation could fail to leave most permanent marks upon the vitality of the forest; yet by the end of the summer the very same trees shewed an exceptional richness of verdure.

The dry, cool spring seems to have produced exactly the check in the development of the leaf that renders it most liable to the attacks of caterpillars, but the cold was not severe enough to inconvenience these pests of vegetation. The continual rain of the later summer came in time, however, completely to change the aspect of things, and produced a second growth of most exceptional richness, the leaves continuing in full vigour so long that the year, in spite of its unfavourable beginning, seems to have been a very healthy one for the trees.

Now, I would only venture to touch very briefly on the complexity of the problems of forestry that such common and apparently trivial matters as these suggest. This problem which we thus saw worked out before our eyes raises a good many very practical points of interest. As it happened, owing to the wetness of the later season, no great harm resulted, but the effect of a dry summer and autumn might have been very disastrous to the forest. It may be said that these are the natural vicissitudes of Nature, and that we cannot interfere with their operation. Is this quite certain? With whatever intention, man *has been* interfering with the forest life, for better or worse, for 2,000 years at least, and it is difficult to say what is really natural now. A careful examination certainly tended to the conclusion that the plague of caterpillars last spring first attacked the overcrowded hornbeams, and only in the second instance the oaks in their vicinity, and especially those that were suffering visibly from overcrowding.

If this be so, it is not nature, but our interference with nature, that has done the mischief. Nay more, it may be that our sudden cessation of interference has left a state of things more unnatural than it was before.

Pardon me if I once more recall to you what was the treatment of the forest from time immemorial. To many here present it was very familiar, and yet just because it is familiar to our minds, we must remember that already it is a forgotten dream to many who, without having known or studied the woodlands, are quite prepared to speak unhesitatingly as to forest management. We must always bear in mind that Epping Forest is but the residue of the great Forest of Essex the boundaries and extent of which have been so carefully studied by our members, and about which our proceedings contain such invaluable papers.[1] The process of more or less authorised enclosure has been going on from the beginning, the temporary use of a bit of forest land growing by lapse of time into a freehold, and the freehold growing and growing, the process from time to time rudely interrupted by those in authority, but in the long run establishing a claim of right.

It is a process familiar enough to any one who has experience of waste land, and gives a meaning to the Mosaic curse against him who removes his neighbour's landmark that is not so apparent to those accustomed to well-defined boundaries.

Of course, the parts of the forest that were thus stolen were naturally the richest and best land, and thus the existing forest is certain to represent the worst soil in the original extent of the forest.

The last idea that would have presented itself to those who managed forest matters was to provide a beautiful recreation ground for London. The public and its rights were unknown quantities; those wandering out of their parish were rogues and vagabonds, and the object in view was not to provide for their enjoyment, but to cherish deer for the Royal Chase and to grow wood and pasturage for the commoners. The system of lopping fulfilled these requirements; for while the "loppings" of the trees had a value for stakes, hurdles, wattle fences and fagots, far beyond anything we now experience, the young growth of the trees induced by this periodical cutting was the favourite food of the deer. The result was not ornamental; those who do not remember when, instead of the dense thickets we now see, every stem was reduced to the appearance of a mop seven feet high, with every vestige of the underwood cleared away, may study for themselves how it was done in the little bit of forest in Theydon Garnon that was not included in the royal forest, and which is still treated on the old system. But though the results were not beautiful, this system rendered the life of the six hundred or so trees per acre far more wholesome than it is now. Every fourteen years or so the ground was thrown open to sun and air, while the size of the trees was kept commensurate with the plant-food obtainable in the limited space available for them.

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[1] This remark is doubtless intended to apply only to the extent of the Forest in comparatively remote times. As we have elsewhere pointed out (*Proc. E.F.C.*, vol. iv., p. clii., and ESSEX NAT., vol. vi., p. ii.), Epping Forest proper (of course excluding Hainault Forest) has not greatly diminished in extent since Charles I.'s time.—ED.

It is very striking to watch the effect of coppicing in the woods in the South of England, where the hazel bushes are periodically cut right down to the ground, and to observe the natural rotation of vegetation that arises from the process. For the first two years a profuse growth of hyacinths and wood anemones covers the ground, afterwards almost disappearing, and giving place to a more varied flora till the nut bushes again overshadow the whole and allow but a scanty mossy undergrowth. Nothing could more clearly mark the total change of the conditions of vegetation in the different stages of the coppicing. A similar periodic change was brought about in the forest by the lopping giving a fresh start to the growth of any tree robust enough to stand the treatment.

The vegetation of the forest was thus no natural growth, but the survival of that fittest to stand this unnatural treatment. How the particular growth that we find came there is most difficult to learn. It is almost impossible to imagine any process of artificial planting, and we must rather look to the inability of other trees to stand the lopping to explain the presence of those now in the forest. There is a similar difficulty in explaining the origin of the hazel coppices of which I have spoken. It is hard to replace hazel bushes if once rooted out; whether the idea that they are the result of squirrels' hoards of nuts be true or not, the only thing that is certain about them is that there they are, and not how they came there.

In dealing with the forest in its present condition, we have therefore the difficult problem, How bring it back to a natural state? If we leave Nature unassisted, it may be that we must wait until caterpillars innumerable have made a desert before Nature again provides a truly natural growth. How long will that process take? Is it not better to help her to get light and air where it is wanted by the quicker process of the axe and mattock?

I have dwelt, perhaps, at too great length upon one of the many problems of interest that the forest affords. May I go further and point out that in these days, when we call out so much for science teaching, we are in danger of overlooking the best method of all of teaching scientific habits of thought, the observation of Nature herself.

What do we mean by teaching science, and what do we hope for from it? Although a self-evident truth, it seems to need constant repetition that what is wanted is not the acquirement of facts and theories only, but of the *method* by which these facts and theories are arrived at. It is not the collection of dried specimens of other people's knowledge, but the power of finding for ourselves, and better still, of cultivating for ourselves, that we need.

The experience of others is no doubt of the greatest value; the slow growth of progress in arts and manufactures in the past has been owing to the necessity for each step in advance to be worked out by slow individual experience without a knowledge of the principles to be worked on, or of the results of other's thoughts and results. Yet the wide stores of fact and theory that are now available to any worker are valueless unless those who would profit by them have grasped the scientific methods of research enough to assimilate and make them their own and carry them out in practice.

Forty years' experience of applied science have concurred in shewing me that in practice the man is hopelessly lost who can not find his own way a great deal further than the best-published results will take him. What we want is research, research, research. I have much more hope of the child who can intelligently find out for himself how to make a mud pie than of the walking dictionary who can give an *unoriginal* answer to any question that can be extracted out of a syllabus of study.

Aristotle was a marvellous observer of Nature, and not less marvellous in his power of systematising, and he did his work so well that for centuries men were content to ask what Aristotle said, not what Nature said. It needed the spirit of the *Novum Organum* to send men back again to Nature. The same danger is abroad now; we may make the labours of men as great or greater than Aristotle a hindrance and not a help for progress, if we are content to follow merely what they have thought and done, and never learn to do or think for ourselves.

The great difficulty lies in examinations; it is comparatively easy to find out how much acquired knowledge a paper shews; it is most difficult to set new problems and make sure that the answer is original.

Now, of that fundamental knowledge of observation and classification on which any real scientific teaching must be based, there is no better source than Natural History and Botany, and other allied subjects, when learned direct from Nature. There are some who affect to despise the collector—the *mere* collector may indeed be a useless pedant, and so may be the *mere* anything else. But the collector who will bring to bear on other subjects the keen observation of nature and of the differences of natural objects; who has grasped the principles underlying systems of classification, and has learned the habit of applying those principles to particular instances; is provided with the essential characteristics for research, and from the only true teacher, Nature herself.

There is another, and it may be more important, reason for studying Nature at first and not at second-hand. It is very possible to feel, at any rate, as if one has reached the limit of second-hand knowledge; but the true and reverent student of Nature herself learns the truer lesson of how much remains unlearned by the wisest—the infinite littleness of our highest knowledge.

THE POST-PLIOCENE NON-MARINE MOLLUSCA OF ESSEX.

By A. S. KENNARD and B. B. WOODWARD, F.L.S., F.G.S.
With contributions by WILFRED MARK WEBB, F.L.S.

[*Read March 6th*, 1897.]

IT is doubtful whether any other English county possesses within its borders so many important and interesting Post-pliocene deposits as are to be found in Essex. Copford, Clacton, Ilford and Grays are well known to every geologist; but besides these classic localities, there are other less known though equally interesting deposits: it is certain, too, that there are many others still waiting for the pick of the geologist to lay bare their secrets. Such deposits are nearly always of but small extent, and their presence is quite unsuspected until they are exposed by some chance excavation. Numerous lists of Mollusca from the various beds have from time to time been published; but it has always been felt that many of these lists are not reliable, and that they are more likely to lead the student astray than to afford him assistance. Our knowledge of the English Mollusca has been greatly increased since the days of the fathers of geology; several species have been added to our list, while, on the other hand, other so-called species have been sunk. Too often the identifications have been made by persons who were not sufficiently acquainted with the living forms, and it is certain that that universal scapegoat, the printer, is responsible for several incorrect records.

Though these beds and their contained shells are too often spoken slightingly of by geologists, no one can deny that accurate lists of the Mollusca must be of great use to the worker in correlating the various deposits, and would, moreover, throw new light on many of the obscure problems of local distribution. It must not, however, be supposed that accurate identification has been by any means an easy task. It is well known to every student of Mollusca that the differentiation of some species is extremely difficult, the microscope having often to be called into use. With fossil examples this difficulty is, of course, greatly increased, since the specimens are very often badly preserved, or may even be mere fragments. Lists, also, have been founded on several collections, which we have quite failed to trace, and a comparison in the table at the end, of the records which are listed on authority, will at once show how great, and perhaps irreparable, has been the loss. The method of procedure adopted, when all attempts to trace a collection have ended in failure, has been to reject all records which were inherently improbable, and to list the remainder on the authority of the recorder.

To Dr. Henry Woodward, F.R.S., we are greatly indebted for affording us every aid in working at the examples under his charge in the Natural History Museum; and Mr. E. T. Newton, F.R.S., and Mr. H. A. Allen, F.G.S., of the Museum of Practical Geology, as well as Mr. James Reeve, Curator of the Norwich Museum, have been equally courteous. To these gentlemen we would here return our most cordial thanks, and would include with them Mr. W. J. L. Abbott and Mr. F. C. J. Spurrell for permission to examine the specimens in their possession. We would also express our gratitude to Mr. W. M. Webb, F.L.S., for kindly examining the examples preserved in the Essex Field Club's Museum, and also for furnishing the list of the species now existing in the county, besides much other assistance noted in the paper. Our special thanks are due to Dr. Frank Corner for placing at our disposal the whole of his collection (a selection from which has been made and is now on view at the Natural History Museum), as well as for many other acts of kindness.

In the ESSEX NATURALIST and in the *Geological Survey Memoirs* mention is often made of the occurrence of shells in Post-pliocence beds as at Yeldham, Audley End, Newport, Little Chesterford, Bartlow, and Marks Tey. The collection of these fossils is pre-eminently the work of local geologists, and we would urge members of the Essex Field Club to carefully preserve any specimens which may be obtained from sections exposed in drainage or other works. Much good work has already been accomplished in this direction by members of the Club, especially by Mr. R. Miller Christy, F.L.S., Mr. R. W. Christy, Mr. J. French, and Mr. W. M. Webb, F.L.S. Our hope is that this paper will act as an incentive to further work, and that more careful and extended research in the future will be the result.

In the table at the end will be found a complete summary concerning this distribution of the various species. In the first column is a list of the British Non-marine Molluscan Fauna (the names of the extinct forms being in ordinary type); in the second column their presence in Essex is noted; whilst in the subsequent columns are placed the various records under the several localities. It has been considered advisable to include a full Bibliography for the convenience of those students who in the future may wish to work at this subject.

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CANNING TOWN.

For our knowledge of this undescribed deposit we are entirely indebted to Dr. Frank Corner who collected extensively from it during its short exposure. The shells were found in layers alternating with mud and peat during the excavation of the sewer from Canning Town to Stratford, south of the railway bridge. Associated with them were bones of a small ox, deer, wolf, beaver, and whale, with a chipped flint celt (all of which are now in the magnificent collection of Dr. Corner). The species are thirty-two in number, and in all probability are of the same age as the Lea Valley examples to be described later. A series from this locality is now on view at the Natural History Museum.

LEA VALLEY.

On either side of the Lea River, between Walthamstow and Clapton, there is a series of peaty and marly alluvial deposits full of molluscan and vertebrate remains. During the construction of the reservoirs of the East London Waterworks Company at the former locality extensive sections were exposed, and these were described by Dr. H. Woodward (15) and a list of the mollusca was given. In 1890, after a careful examination of the original materials, Mr. B. B. Woodward published a list of forty species (31). Dr. Frank Corner kindly placed at our disposal a series of shells found by himself in August, 1894, in alluvium about eight feet from the surface at New Park, near White House, Lea Marshes, associated with wooden pin and neolithic flakes. The species are thirty-four in number and are listed with the Walthamstow examples as they came from the same series of beds. There are, however, ten species not hitherto recorded, viz.:—

Agriolimax agrestis
Vitrea cellaria
Helicella caperata
Helix aspersa
Succinea elegans
Planorbis carinatus
Vivipara contecta
,, *vivipara*
Anodonta cygnæa
Pisidium pusillum.

Later on Dr. Corner sent us a further collection from the same series of beds recently exposed in excavation for a new reservoir and from this was obtained three more new records, viz : *Vitrea fulva*, *Physa hypnorum*, and *Velletia lacustris.*

The most noteworthy of these is *Helix aspersa* since this is the first time we have seen this species apparently in association with pre-Roman objects in this country. *Agriolimax agrestis* and *Vivipara contecta* are new records for the Holocene deposits of the London district, though both species are known from the Pleistocene. The occurrence of *Acanthinula lamellata* at Walthamstow must also be noticed, since this is the most southerly locality in which it has been found. At the present day its southern limit is Staffordshire.

TILBURY, VICTORIA AND ALBERT DOCKS.

The mollusca obtained from the peat exposed during the extensive excavations for Docks are the only Essex specimens from the Thames alluvium which we have seen, the Canning Town examples belonging in all probability to the Lea Valley. The sections were referred to and a list of the species given by Mr. B. B. Woodward (31). The species are twenty-four in number, and are now either at the Natural History Museum or in the collection of the Geographical Society.

WITHAM.

In the *Geological Survey Memoir* on the *North-west part of Essex* (18) is a list of seven species of Mollusca from "the post glacial beds at Witham copied from a manuscript list by the late Dr. S. P. Woodward," which list is now in the possession of one of the writers. The examples from which the list was compiled were collected by Mr. John Brown, F.G.S., of Stanway, and Mr. French is of opinion (27) that they probably came from the shell-marl found in the High Street during an excavation for a sewer. In the Natural History Museum there is a fine series from this locality some of which are evidently from the "John Crown collection." On going over them thirty species have been identified, twenty-four of which are unrecorded, but no example of *Vertigo pygmæa* could be found. We have, however, listed it on the authority of the recorder. Two alterations are necessary in the nomenclature *Pupa palustris* is a synonym for *Vertigo antivertigo*, while *Clausilia rugosa* is now called *C. bidentata*, The occurrence of *Paludestrina ventrosa* is noteworthy since it is a brackish-water form. *Pomatias elegans* is represented by numerous examples and its presence furnishes additional proof of the former abundance of this species in the county.

There are also at South Kensington thirteen species from Raine and four from Braintree. The shells from the latter locality are:—

Planorbis nautileus
Bythinia tentaculata
Valvata piscinalis
,, *cristata.*

From the former were taken:—

Velletia lacustris
Limnæa auricularia
,, *pereger*
Planorbis glaber
,, *nautileus*
,, *marginatus*
Planorbis spirobis
,, *contortus*
,, *fontanus*
Bythinia tentaculata
Valvata cristata
Pisidium fontinale
Limnæa stagnalis.

Since the several deposits from which these shells were obtained are close together, and are without doubt of the same age, it has been considered advisable to list them together.

FELSTEAD.

Attention was first called to this deposit in 1882 by Mr. J. French (24) who gave a short description and probable history of the various recent beds in his parish and incidentally mentioned the occurrence of several species of shells. This was supplemented in 1889 by a further paper (27) and a list of forty-two names given, many of which had been identified by Mr. J. W. Taylor, of Leeds. Through the kindness of Mr. W. M. Webb we have been able to verify six species from examples now in the Essex Field Club's Museum; but the original specimens have so far not been seen by us.[1] This is the more to be regretted because this deposit is without doubt one of the most interesting in the county. The six species we have seen are:—

Acanthinula aculeata
,, *lameliata*
Pupa anglica
Vertigo substriata
Pomatias elegans
Acicula lineata.

Two of the records are probably incorrect, viz., *Helicella cantiana* and *H. carthusiana*, and we have omitted them, the remainder are listed on the authority of Mr. French. We would, however, here point out that we have ignored in our remarks and conclusions all records which we have been unable to verify.

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[1] Mr. French is very kindly going to send the specimens for verification, but too late for comment in the present paper.

CHIGNAL ST. JAMES.

This deposit is situate on the right bank of the Cann, a tributary of the Chelmer, 3½ miles north-west of Chelmsford and 5½ from the brook's source. The first published account of the Mollusca from this locality was in 1879 by Mr. J. E. Clark (20), who listed sixty-one species on the authority of Mr. Miller Christy, but of this number eleven are noted as only occurring in the surface soil. A section and map was given, and Mr. Clark pointed out that some of the species were locally extinct, whilst on the other hand some species now abundant in the locality were absent. The next notice was in the ESSEX NATURALIST in 1889 by Mr. Miller Christy (25), abundant details of the deposit being given, with a list of the Mollusca, and notes on the occurrence and absence of certain species. Mr. Christy's specimens are now in the Essex Field Club's Museum, and we have to thank Mr. W. M. Webb for placing at our disposal his notes on these examples and for enabling us to examine critical specimens. There are forty-eight species represented, five of which are new, viz., *Vitrea excavata*, *Vitrea nitida*, *Vertigo moulinsiana*, *Physa hypnorum*, and *Pisidium pusillum*.

Eight names have been rejected, viz. :—*Agriolimax agrestis*, *Helix* [=*Pyramidula*] *rupestris*, *Helix* [=*Helicella*] *caperata*, *Balea perversa*, *Succinea elegans*, *Physa fontinalis*, *Sphærium corneum*, and *Pisidium nitidum*.. These are unrepresented by specimens, and many of them are due to oversights in identification. The surface soil in one place also contains a large number of shells which of course are of much later date than those in the deposit proper.

It is noteworthy that no less than ten species have been found in the newer bed which do not occur in the older one, viz. :—

Limnæa pereger
,, *auricularia*
,, *palustris*
Bythinia leachii
Pisidium amnicum

Planorbis contortus
,, *carinatus*
,, *marginatus*
,, *corneus*
,, *vortex*.

Of course it is quite possible that these species existed in the neighbourhood at the time of the deposition of the older bed and that their absence is the result of accident; yet, considering that they are all freshwater forms, it is by no means improbable that these species have migrated into this district in more modern times. There are other forms also now living in the brook which are unrepresented in both beds and which may be of still more recent introduction.

ROXWELL.

In 1889 Mr. R. W. Christy, in a paper read before this Club and published in the ESSEX NATURALIST (26), listed twenty-six species of Mollusca found in an alluvial deposit which had been exposed during the process of draining a field on Duke's Farm, Roxwell. The examples are now at the Natural History Museum.

SHALFORD.

Mr. W. M. Webb sent for our inspection a series of shells from Shalford, five miles N.W. from Braintree. These had been obtained from a small quantity of material sent to him by the Vicar, the Rev. A. J. Law, that had been taken from a drain at a depth of 3—3½ feet in "the Marsh," situate 400 yards S.E. by S. from the Vicarage, and 2,500 yards N.W. from Abbott's Hall. The species are thirty-three in number and the deposit is of the same age as those at Chignal and Roxwell. Should it ever be again exposed it is to be hoped that further investigation will be made, as there is no doubt that only a small portion of the molluscan fauna is exemplified in the material obtained as above mentioned.

COPFORD.

To the late Mr. Searles V. Wood fell the honour of first calling attention to the beds at Copford, perhaps the most interesting, certainly the best known, of all the Essex deposits. In March, 1834, he mentioned that he had received examples of *Valvata piscinalis* from this locality, and asked for further information (1). In answer to this, a letter appeared two months later from Mr. J. Brown, of Stanway (2), who stated that all the shells were very badly preserved, and that he had only succeeded in obtaining perfect specimens of *Valvata piscinalis*, *Planorbis sp.*, and *Cyclas rivicola.* Two years later (3) he mentions as occurring "two species of *Valvata*, *Lymneus sp.* (apparently *stagnalis*), *Lymneus glutinosus* and *Paludina sp.*;" while in 1838, Professor John Morris records *Limnea pereger* and *Valvata piscinalis* (5). It is very evident from the above that the shell bed which has since made Copford famous was not exposed at this time. During the next five years, however, the bed was laid bare, for in 1843 Mr. J. Brown listed thirty-eight names on the authority of Dr. S. P. Woodward (8). In 1852 Mr. Brown issued another list (10) containing sixty-four names, Mr. Pickering being this time responsible for the identifications ; whilst four years later (11) Mr. S. V. Wood recorded sixty-three species, and figured *Helicella incarnata*, Müll., from this locality. He mentioned, however, that the two or three examples which he considered to be this species were not in good preservation, and that the determination was doubtful. The last-published list was issued in 1880 by the Geological Survey (21), and added nothing except errors. It is a matter of congratulation that Mr. Brown's original specimens from which all the lists were compiled are now at the Natural History Museum, and that consequently the work of checking has been comparatively easy, though it should be mentioned that through the generosity of Mr. Brown examples are to be found in several museums and many private collections. The following species have been excluded, no specimens being forthcoming :— *Limax carinatus*, *Vitrea alliaria*, *Helix* [=*Hygromia*] *fusca*, *Helix* [=*Eulota*] *fruticum*, *Bulimus acutus*, [=*Helicella barbara*], *Achatina* [=*Cæcilianella*] *acicula* (originally given with a query), *Vertigo minutissima*, *Limnæa* [=*Amphipeplea*] *glutinosa*, *Bythinia ventricosa* [=*leachii*], *Anodonta cygnea*, *Corbicula fluminalis*, *Sphærium rivicola*, *Pisidium amnicum*, and *Helix* [=*Helicella*] *incarnata*. *Clausilia plicatula* is a synonym for *C. rolphii*, and *Helix depilata*, *H. concinna*, and *H. plebeia* are only varieties of *Hygromia hispida*. Mr. Brown has recorded *Helix hortensis*, and examples so labelled are at the Natural History Museum. As every malacologist is aware, there is sometimes a difficulty with recent examples in stating definitely whether a shell belongs to this species or to *Helix nemoralis*, and in fossil examples where the coloration is nearly always destroyed the difficulties are greatly increased. We are, however, of opinion that in this case the identification is correct.

So full are the original lists that there are only six species to add, viz. :—*Vitrea excavata*, *Helicella caperata*, *Vertigo moulinsiana*, *Ancylus fluviatilis*, *Planorbis fontanus*, and *Paludestrina marginata*. There has always been considerable difference of opinion as to the exact age of the Copford beds, and unfortunately the evidence from the mollusca is rather contradictory. *Pyramidula ruderata* and *Paludestrina marginata* are confined to beds of Pleistocene age in this country; while, on the other hand, *Buliminus obscurus*, and *Pupa anglica* are not known to occur in any but Holocene deposits. The presence of some of the larger mammalia, as the Mammoth and Rhinoceros, is of little use in determining the exact age, since we now know that they lingered on in this country into Neolithic times. Judging, however, from the general facies of the Mollusca, we consider that it certainly is much later than either Grays or Clacton, and if it be Pleistocene at all, it belongs to the end of that period.

The record of *Paludestrina marginata* may, however, be incorrect, as it is not given in Mr. Brown's list, and the examples were picked out of his material at the Natural History Museum, so that it is quite possible that these may have got in by accident. There is also a possibility that there may have been two beds, one of Pleistocene and one of Holocene age, and that the fossils have been mixed together. On examining the shells a difference in their preservation is to be noted, so that considerable doubt must always be thrown on any deductions based on these specimens. The section is now overgrown, but should it ever be again opened, it is to be hoped that some competent observer will, by careful investigation, clear away the difficulties which at present beset the true interpretation of this deposit.

CLACTON.

The beds at Clacton were first described by Mr. John Brown, F.G.S., of Stanway, in 1840, and a section given (6), the figure of which is marked "near Walton." He pointed out the extraordinary abundance of shells there, and promised a list on a future occasion. This promise was fulfilled in the following year, when a list of twenty-five species was given on the authority of Mr. J. D. C. Sowerby (7), two of which were described as new, viz. :—*Planorbis helicoides* and *Helix conoidea*. The next and the most important list was by Mr. S. V. Wood in 1856, and contained fifty-nine names (11). Mr. Wood had worked at Clacton for some years, and the species are his own determination. In 1866 Mr. S. V. Wood, junr., incidentally noted that the Rev. O. Fisher had found two species which his father had failed to find, namely, *Paludina lenta* and *Corbicula fluminalis*. Two years later, in 1868, the Rev. O. Fisher (13) gave a full description of the beds, but added nothing to our knowledge of the Mollusca. The last list was given in 1880 in the *Geological Survey Memoir on the Neighbourhood of Colchester* (21), a production which was very adversely criticised in 1886 by Mr. A. Bell (23). In 1894 Mr. W. M. Webb (32) published in the ESSEX NATURALIST a Catalogue of species from Walton-on-the-Naze. The examples on which this list was founded were presented to the Essex and Chelmsford Museum by Mr. J. Brown many years ago (they are now in the Museum of the Essex Field Club), and with them was a printed slip stating that they were found "with the fossil horns above at a part of the Essex coast five miles southward of Walton Naze." After a due consideration of all the facts, we have come to the conclusion that there is a printer's error in the above, and that the correct reading should be ten miles instead of "five," and that consequently the specimens come from Clacton. In the first place no such deposit except Clacton from which these shells would be likely to come is known, though repeated search has been made in the locality indicated. There are only two species in Mr. Webb's list which are not known from Clacton, viz., *Helicella caperata* and *Vertigo moulinsiana*; but in the printed slip these are given as *Helix concinna* and *Vertigo pygmæa*, both of which are recorded from Clacton by Mr. S. V. Wood, and the two missing species, *Sphærium corneum* and *Valvata piscinalis*, are in the Geological Society's Museum from Clacton. With regard to the horns, Mr. J. Brown described in 1838 [*Mag. Nat. Hist.* (ser. 2), vol. ii., p. 163] a large pair of horns found at Clacton. Moreover, Mr. Brown was most careful in placing on record the various geological sections in Essex, and it would indeed be strange if he had omitted to describe so important a section, judging by the fossils. The examples in the Natural History Museum also described by Mr. Webb are undoubtedly from Clacton. So that, taking the above facts into consideration, it may be considered as certain that Clacton is the true locality, and with this conclusion Mr. Webb concurs. The section is now a thing of the past, consequent on the growth of the town, but we have been able to examine five collections; consequently, the verification of past records has not been difficult. There is a fair collection in the Natural History Museum, one buried in the Geological Society's Museum, the third (whose origin we have just discussed) is now in the possession of the Essex Field Club, whilst Mr. S. V. Wood's specimens are at present in the Norwich Museum, and we must thank Mr. J. Reeve, the curator, for his kindness in giving every facility for examining the specimens under his care. There is also a small series in the Prestwich Collection at the Natural History Museum, for a knowledge of which we must thank Mr. R. Bullen Newton. From these we have been able to verify forty-six species. Of the two described as new by Mr. Sowerby, *Helix conoidea* is certainly *Hygromia hispida*.

The identification of *Planorbis helicoides* is not quite so certain. No figure is given as with *H. conoidea*, and we have only the description to guide us. Mr. A. Bell has suggested *P. glaber*, but this is not likely, as *P. lævis* (a synonym for *P. glaber*) is recorded. But from the statement that it resembles *P. lineatus*, but without the septa, we are of opinion that *P. fontanus* is the shell meant, and examples of this species are in the Geological Society's Museum. The following have been omitted, being far too uncertain :—*Helix umbilicata* [=*Pyramidula rupestris*], *Helix* [=*Hygromia*] *rufescens*, *Achatina* [=*Cæcilianella*] *acicula*, and *Helix* [= *Vitrea*] *alliaria*. *Clausilia biplicata* is an error in identification for *Clausilia rolphii*, and *Helix virgata* for *Helicella caperata*. *Paludina minuta* is now *Paludestrina marginata*, *Paludina thermalis* is *Paludestrina ventrosa*, *Paludina impura* is *Bythinia tentaculata*, *Clausilia bidens* is *Clausilia laminata*, *Pupa palustris* is *Vertigo antivertigo*, and *Pupa cylindrica* is *Vertigo minutissima*.

There still remain, however, fifteen species to be accounted for, and these we have listed on the authority of the first recorder for what they may be worth. In the *2nd Supplement to the Crag Mollusca*, p. 69, Tab. 1, fig. 4, A and B (19), are the description and figures of two specimens of *Paludina* found at Clacton by the Rev. O. Fisher, for which Mr. S. V. Wood proposed the name of *P. clactonensis*, but pointed out that a shell from the diluvium at Templehof, near Berlin, called *P. diluviana*, Kunth (*Zeitschrift. Deutseh. Geol. Geschellschaft*, Berlin, 1865, Tab. 7, fig. 8), very much resembles these specimens, and may be identical. (These are the shells referred to by Mr. S. V. Wood, junr., as *Paludina lenta*, see *ante*). Another example has since been found by Mr. A. Bell. Professor C. L. F. Sandberger, however, is of opinion that the two forms are quite distinct, and that the nearest allies to the Clacton shell are *Vivipara lenzi*, *moisisovicsi* and *brusinai*, Neumayr, from the Congeria beds of Sclavonia. The type specimens are in the Woodwardian Museum at Cambridge, and we regret that lack of opportunity has up to the present prevented us from examining them.

There are five new records :—*Helicella caperata*, *Clausilia rolphii*, *Vertigo edentula*, *V. moulinsiana*, and *Physa fontinalis*. The four latter species being all new for the Pleistocene of Essex.

The examples of *Unio littoralis* are said to have often had the two valves united, and several pairs are known, one of which at the Natural History Museum is remarkable for having traces of its coloured periostracum preserved. It measures 69 x 47 x 28 mm. Numerous marine shells have also been recorded from this locality, besides several species of Ostracoda and plants.

SHOEBURYNESS.

In the Prestwich Collection are numerous examples of *Corbicula fluminalis* labelled Shoeburyness. That the locality is correct there can be no doubt, as the late Professor Prestwich mentions its occurrence there in one of his early papers. We can obtain no further information about this deposit, and we would call the attention of members of the Essex Field Club to it, in order that it may be properly investigated.

HARWICH.

The only published list of shells from this locality is to be found in the *Geological Survey Memoir on Walton Naze and Harwich* (16), and contains fourteen names on the authority of a M.S. by the late Dr. S. P. Woodward. So far as we can trace there are only two collections extant—one at the Natural History Museum, a part of the Lyell collection and containing ten species; while five species are in the Geological Society's Museum. From these collections we are able to verify five records, whilst seven species are new, and nine in the published list are unrepresented. The new records are :—

Helix nemoralis
Vertigo antivertigo
Vertigo angustior
Carychium minimum
Limnæa palustris
Paludestrina ventrosa
Succinea elegans.

The missing species are listed on the authority of the recorder, but some changes in the nomenclature are necessary :—*Bythinia ventricosa* = *Bythinia leachii*, *Clausilia nigricans* = *Clausilia bidentata*, *Helix spinulosa* = *Acanthinula aculeata*, *Zonites rotundatus* = *Pyramidula rotundata*. *Littorina* sp. is also included in Dr. Woodward's list : the presence of which, with *Paludestrina ventrosa*, clearly indicate slightly estuarine conditions. One of the examples of *Limnæa palustris* is noteworthy as it is the very short dumpy form only known elsewhere in England from the Pleistocene beds of Crayford and Erith.

As to the age of these shells we have but little to guide us. Since all the species are known from the Pleistocene and all characteristic Holocene shells are absent, we are inclined to consider them as belonging to the older series, and in all probability of the same age as the Clacton examples.

GRAYS.

The first notice of the deposit at Grays was by Professor Morris in 1836 (4), but although the occurrence of shells was noted no names were given. Two years later, however, he published (5) a list of sixteen species Mr. G. B. Sowerby describing the high spired variety of *Valvata piscinalis* as a new species under the name of *V. antiqua.* In 1856 S. V. Wood's *Monograph on the Crag Mollusca* was published (11) and on the authority of Mr. Pickering, he recorded forty-nine species as occurring there. The next list was by Professor Boyd Dawkins in 1867 (12) and contained only nineteen names, but two years later Mr. A. Tylor listed fifty-two species (14) Mr. Pickering again being the authority. In 1882 (22) S. V. Wood, jun., noted that although *Unio tumidus* was abundant, he had never found *U. littoralis*; but he added that his father possessed specimens from this locality given him many years before by Sir Charles Lyell. The last list was in 1890 (31), when, after a critical examination of all the existing material and published lists, Mr. B. B. Woodward recorded twenty species on the authority of their various recorders and thirty from existing examples. It has been considered advisable to make a few alterations, though no fresh material has come to hand, all efforts to trace Mr. Pickering's specimens having failed. When the last list was given, no example of *Planorbis carinatus* was known from any Pleistocene deposit of the Thames Valley. It had been recorded by Professor Morris, A. Tylor, and Professor Boyd Dawkins from Grays, but as there had been such confusion between this species and *P. marginatus* it was deemed prudent to omit it. Since then it has been found in abundance at Ilford and at the Admiralty Section, so it is now included for Grays on the authority of Professor Morris, the first recorder. *Balea perversa* and *Hyalinia fulva* have been omitted, S. V. Wood being of opinion that the record of the former given by himself was an error in identification. In the *Journal of Conchology* for 1892 (page 64) is a note "that *Valvata piscinalis* var. *antiqua* Sow. is now considered to be practically the form named by Dr. Jeffreys var. *subcylindrica* and as Sowerby has priority it has been adopted." It is no doubt desirable to relegate to obscurity many of the names given to the so-called "varieties" of our British shells, but in this case two perfectly distinct forms have been confounded. Dr. Jeffreys expressly states that his form *subcylindrica* has a flattened apex. A reference to the original figures of var. *antiqua* (5) would at once have shown the author of the above remark that in this variety there is a perfectly regular spire and no trace of flattening. We have never seen living examples of *antiqua* from the British Isles, though according to Dollfuss (1884. *Ann. Soc. R. Malacol. Belg. xix., Mém.* pp. 33 note), it is now living in the canals of Northern France. On the other hand we have seen examples of var. *subcylindrica* from four or five localities.

The shell figured by S. V. Wood, *1st Supp. Crag. Moll.*, Tab. III., fig. 21, as *Potamides sp.* from Grays, is without doubt a derived specimen from the Eocene beds of the neighbourhood. In the original notice of *Unio littoralis* as a British fossil (5) there is an error in locality. The figure of the shell is labelled Grays, while in the accompanying list it is only recorded from Erith, and in the text no mention is made of Grays, so there can be no doubt that it was not known from the latter place till a subsequent date. The earlier geologists were rather careless about exact localities, the formation being considered sufficient. This may account for some examples of *Unio tumidus* at the Natural History Museum being labelled Crayford. This species has never been found at that place, and judging by the condition of the shells themselves, Grays should be substituted for the present incorrect locality.

WEST THURROCK.

There, in the pit belonging to the Tunnel Cement Works Company, Mr. W. J. Lewis Abbott, F.G.S., found some shells on loamy clay with sandy patches that rested on a series of sands and gravels overlying the chalk and abutting against an escarpment of the latter. The list is not large and the specimens are in a very fragmentary condition, with the exception of an abnormal example of *Helicella itala.* This specimen was picked off the stuff that had been thrown down from the section and must have come from one of the sandy patches mentioned. The other shells are:—

Pupa muscorum
Limnæa pereger
Planorbis corneus ?
Planorbis spirobis
,, *marginatus*
Bythinia tentaculata.

With the exception of *H. itala*, all the species are found at Grays, and as they come from the same series of beds they are so included in the table.

ILFORD.

To Professor J. Morris we are indebted for the first list from this locality. This was in 1838, and contained ten names (5). In 1867, Professor Boyd Dawkins quoted twenty species as occurring (12), and the list was further extended in 1869 by Mr. A. Tylor on the authority of Mr. Alfred Bell (14); while in 1890 Mr. B. B. Woodward listed twenty species from existing specimens and ten on the authority of the several recorders (31). It must always be a matter of regret that a small portion of the energy which was devoted to obtaining the Vertebrate remains was not directed to the Mollusca, especially since the shell-beds are now worked away. That the shells were formerly extremely common there is no reason to doubt, as Dr. Cotton remarked in 1847, "The two genera of shells of which hundreds may often be obtained at one visit are *Helix* and *Cyrena*, but *Unio* and *Planorbis* are not uncommon, and *Ancylus*, *Succinea*, *Valvata*, *Limnæus*, *Cyclas*, and *Paludina* have been discovered. They are chiefly seen in the layers of sand upon which the brick-earth reposes and beneath the bones, but are sometimes intermixed with them, and have been found even within the cavities of the bones. They appear to be partial in their distribution, and are not met with in the former cutting (*i.e.*, north side of London Road—Curtis' Brickfield) (9). For some years past Dr. Frank Corner has assiduously collected at Ilford, and he most generously placed his collection at our service. Mr. W. M. Webb has also a few specimens, one of which, *Succinea elegans*, is a new record. Dr. Corner's collection has enabled us to materially swell the list, no less than ten species being new, viz.:—

Helicigona arbustorum
Helicella virgata
Pupa cylindracea
Valvata cristata
Planorbis glaber
Planorbis vortex
,, *spirobis*
,, *contortus*
Pisidium astartoides
,, *pusillum.*

We have also been able to verify from the same source four records of which no examples were known :—

Limnaea stagnalis	*Anodonta cygnæa*
Planorbis carinatus	*Sphærium corneum.*

Of the new records, two are of great interest :—*Helicella virgata* and *Pupa cylindracea*. The former is known from the Pleistocene of Barnwell, near Cambridge, but has hitherto been unrecorded from the Thames Valley in either the Pleistocene or Holocene. This is the more remarkable as it is an abundant form at the present time. *Pupa cylindracea* has only once been recorded from the Pleistocene namely, from Clacton—and even in this case the record is extremely doubtful. It is unrecorded in the Thames Valley from the beds of either age, though it is common at Copford.

The addition of *Pisidium astartoides* was to be expected, since until lately it was only considered a variety of *P. amnicum*. In the Museum of Practical Geology are two shells of exceptional size from Ilford an example of *Limnæa palustris* measuring 29 mm. alt. and one of *Bythinia tentaculata* 15 mm. high. A *Limnæa* in Dr. Corner's collection differed so much from all British forms that we submitted it to Dr. O. Boettger, of Frankfort, and we would here take the opportunity of expressing our thanks for the trouble he has taken in the matter. He remarks that it is quite new to him, but is near to *L. palustris* var. *diluviana*, And. As we are of opinion that it is undesirable to describe new species or varieties from single examples, we have considered it a variety of *L. palustris* for the present, with the hope that more examples may be found, so that its true position may be ascertained.

In 1869, during the discussion following Professor W. B. Dawkins' paper "On the Distribution of the British Post-glacial Mammals" (*Q.J.G.S.*, vol. xxv., p. 192), Dr. Gwyn Jeffries mentioned that *P*[illegible] and *Eulota fruticum* occurred at Ilford. The latter record is, of course, correct, but our efforts to trace examples of the former have been unsuccessful. Dr. Jeffries' collection is in America, and in answer to our enquiry Mr. W. H. Dall wrote that there were no examples of *P*[illegible] in it; but as there is no inherent improbability in the record, we have listed it on the authority of Dr. Jeffries.

CHELMSFORD.

In 1895 Mr. W. M. Webb recorded eight species of shells from the Pleistocene brick-earth at Chelmsford (33). They are all common forms of that period, and chiefly interesting because it is an entirely new locality for Molluscan remains. It has, however, been considered advisable to tabulate them, because there is a possibility that they may be of a slightly different age from the other Essex Pleistocene shells.

NOTE. Since the above was in type we have had the opportunity of examining the late Professor Prestwich's collection (now preserved in the Natural History Museum), and we were pleased to find in it examples of *Unio pictorum* from Ilford and Grays. This is a new record, or rather authentication, for the Pleistocene of the Thames Valley and the view that it was a late introduction into that part of England must now be discarded.

AGE OF THE DEPOSITS.

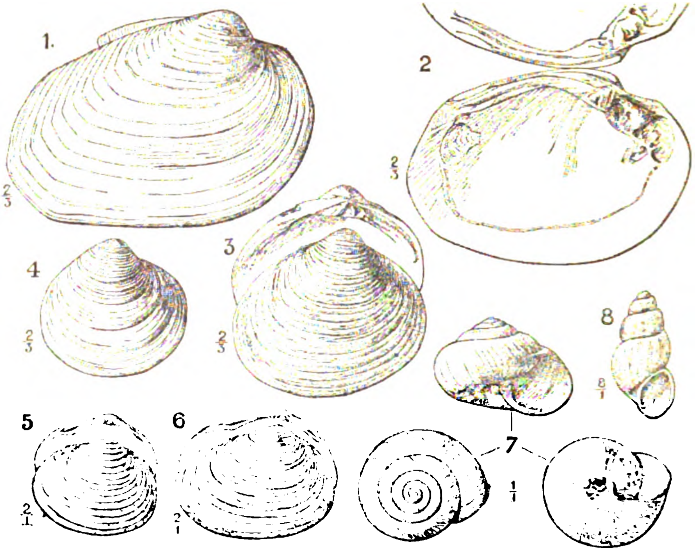
As to the relative age of the Beds, it is impossible to speak with certainty. Roughly speaking, the Holocene deposits can be divided into two groups: Canning Town, Lea Valley, and Tilbury belonging to one; Chignal St. James, Felstead, Roxwell, Shalford, and Copford forming another: while Witham has affinities with both. In all probability, the differences between these groups arises not from a later or earlier age of deposition, but from a difference in origin; the former belonging to the larger, while the latter was deposited by the smaller, streams. The extraordinary abundance of *Vertigo* at Copford and Chignal is unparalleled, but in the *Journal of Conchology*, July, [illegible], p. [illegible], is an account of the rejectamenta of a small river at Portsalon, Co. Donegal, by Mr. R. Standen, in which a similar state of affairs was found to occur, and there can be little doubt that these deposits were formed in a like manner.

With regard to the Pleistocene deposits, Grays and Ilford are probably of the same age, while [illegible] may also be classed together; the relation [illegible] latter to the former is still a matter of pure conjecture.

NOTES ON SOME OF THE SPECIES.

Individual variation, though [illegible] a glance at any "variety" [illegible] even more marked in former [illegible] gratulation that no variety-monger has turned his attention to the Mollusca now under consideration. The more remarkable deviations from the type have been noticed under each locality, it being considered unnecessary to mention the normal variations.

One previously expressed opinion that *Helix hortensis* was unknown from any deposit has proved to be incorrect, since it occurs at Chignal, Copford, and Clacton. It is, however, very remarkable that this species, so common at the present time, should be so rare in a fossil state.



Non-Marine Mollusca from the River Drift, (with the exception of No. 6 extinct in Britain. The original specimens are in the British Museum.

1, 2. *Unio littoralis*, Erith.
3, 4. *Corbicula fluminalis*, Crayford.
5. *Pisidium astartoides*, Crayford.
6. *P. amnicum*, Crayford
7. *Helix fruticum*, Ilford
8. *Paludestrina marginata*, N. E. London

The absence of *Helix pomatia* furnishes additional proof of the theory that it is post-Roman in its introduction into this country. *Helix aspersa*, as we have already mentioned, has now apparently been recognised from a pre-Roman deposit in the Lea Valley, and outside our area it has been recorded from a Neolithic Kitchen Midden at Hastings.

Eulota fruticum is only known from Ilford, the record for Copford being an error for which in all probability the printer was responsible. Elsewhere in England the only known localities are Barnwell, where it was fairly common, and Stutton, in Suffolk, where a single example was found by Mr. S. V. Wood. When the streams on which these several localities occur are traced to their sources it will be seen that the Roding, the Stour, and the Granta (which joins the Cam just above Cambridge) all rise within a short distance of each other in North-west Essex; so it seems a not unnatural inference that this species may have formerly had its head-quarters there. In which case Essex Naturalists should look for it in the deposits of the Chelmer and Blackwater, which likewise rise in that area, especially since Mr. W. H. Dalton (ESSEX NATURALIST, vol. iii, 1889, p. 10) mentions some Helices resembling this species being found at a point seven miles north-west of Colchester.

The former presence of some species which at the present time are more northern in their distribution should be noted: such as *Acanthinula lamellata*, *Pupa anglica*, and *Vitrea excavata*. The first-named must formerly have been very abundant, since it occurs in profusion at Copford, and it has also been found in four other localities. Why these species should have died out in the county is a problem to which we can suggest no answer.

With two exceptions, all the existing species of *Vitrea* have been found; the missing ones being *V. alliaria*, so abundant at Ightham, and the so-called *glabra*. What the correct name for this latter species really should be is still a matter of dispute.

Succinea oblonga is only known with certainty to occur in the Chelmsford Brick-earth and Clacton. At the present time it is unknown in the home counties, though it formerly occurred at Battersea, and examples from that locality are now in the Natural History Museum.

Acicula lineata is another species which was formerly extremely abundant. Though it has not yet been recorded in a living state from the county, this may arise from the fact that it is a very local species and difficult to find.

The diminution in area of distribution of [illegible] is very marked, as it is now only living in one locality. A similar state of things occurs in Suffolk, where in the eastern part of that county, it has become extinct.

Planorbis glaber is a form which is certainly less common than formerly. In spite of a former protest, many persons persist in misidentifying this species with *P. parvus*, Say., so that it may be as well to take this opportunity of repeating Dr. Dall's verdict, which is: "*Planorbis glaber*, Jeffreys, in my opinion, is distinct from *P. parvus*. The latter is flatter and less deeply umbilicated, and shows much more of the whorls within the outer one. It is also distinctly less polished in the average specimen."[2] As *P. glaber* is known from Pliocene deposits in this country, it is probable that these forms are descended from a common ancestor.

Helicella caperata is the only species that has apparently increased in size since the Pleistocene, all the other forms having certainly diminished, as the figures we have given well shew.

There can be no doubt that the Pleistocene molluscan fauna was in every way a finer one than that now existing, in spite of the fact that perhaps a dozen species have been introduced through human agency; though this does not appear to be so numerically in our table owing to the imperfection of the record. Nevertheless the figures for the older period now given show a decided increase on those to be found in "The Pleistocene (non-marine) mollusca of the London District" (31), and future work is certain to augment them.

CONCLUSIONS.

On comparing the Table accompanying this paper with the one published in "The Pleistocene Mollusca of the London District" (31) a great advance in our knowledge of the geological history of our non-marine shells will be noted. Species then only known from the Holocene have had their range extended to the Pleistocene; gaps in the records have been filled up, and many doubtful records have been confirmed. Of the seven species which we have noted as having become extinct in Essex in Holocene times it is extremely probable that three of them may yet be found living in the county, viz., *Acicula lineata*, *Vertigo angustior*, and *Clausilia rolphii*. They are all local forms and are to be found living in the adjoining counties, so that it is not too much to hope that they may yet be added to the list of Essex Mollusca.

[2] Co-types of these two species sent over by Dr. Dall for the purpose are preserved in the Natural History Museum.

polymorpha, Pall	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Unio littoralis, Lam	..	..	..	..	..	..	..	..	..	..	..	+	..	+	..	..
pictorum, Linn	..	+	..	+	..	..	..	..	..	..	..	..	..	+	+	..
tumidus, Retz	..	+	..	+	+	..	..	..	..	..	..	..	..	+	+	..
margaritifer, Linn	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anodonta cygnea, Linn	..	+	..	+	..	..	..	..	..	..	..	+	..	+	+	..
Corbicula fluminalis, Müll	..	..	..	..	..	..	..	..	..	..	..	W	..	+	+	..
Sphaerium rivicola, Leach	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *corneum*, Linn	..	+	+	+	+	+	..	..	..	..	..	+	..	+	+	..
— *ovale*, Fér	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *lacustre*, Müll	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pisidium amnicum, Müll	..	+	+	+	+	..	..	..	..	+	..	+	..	+	+	..
astartoides, Sandb	..	..	..	..	..	..	..	..	..	..	..	+	..	+	+	..
pusillum, Gmel	..	+	+	+	..	..	+	+	+	+	+	B	S	W	+	..
nitidum, Jenyns	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..
fontinale, Drap	..	+	+	+	+	+	+	+	..	..	+	+	..	+	+	..
milium, Held	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals ..... { Living	138	108	32	52	24	42	39	48	26	33	60	61	21	45	42	8
{ Extinct	7										2	5		4	4	

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* [illegible] modern classical authorities [illegible] is an adjective declined like *acer* and not like *niger*.

† By some identified as *Vitrea helvetica*, Blum.

[illegible] living in England occur in the Pleistocene
[illegible] Essex „ „ Holocene.
[illegible] in Essex have been found in the Pleistocene only
[illegible] „ „ „ Holocene only
[illegible] have not been found fossil at all
[illegible]

B on the authority of Mr J. Brown.
D „ „ Prof W. B. Dawkins.
J „ „ Dr. J. G. Jeffries.
M „ „ Prof J. Morris.
S „ „ Dr S. P. Woodward.
T „ „ Mr. A. Tylor.
W „ „ Mr S. V. Wood, Sen.

There are only five living species which, although found in the Pleistocene are unknown in the Holocene. We have already noticed *Helicella virgata*, the unique example of which was found at Ilford. *Buliminus obscurus* is only known from Copford and from a post-Roman hill-wash at Otford, Kent. The absence of *Paludestrina stagnalis* [=*P. ulvæ*] is due to the fact that it is a brackish-water form; whilst *Planorbis lineatus* is known from several Holocene beds in the London district, and its non-occurrence is merely an accident and *Buliminus montanus* is found in the Holocene tufa at Blashenwell, Dorset.

Of the seven forms only known from the Holocene no less than four have been recorded from the older series in other parts of England *Vivipara contecta* at Crayford, *Pomatias elegans* and *Cæcilianella acicula* from Ightham, whilst though we have seen no Pleistocene examples of *Planorbis corneus* from Essex, yet since it is a common form of that period and has been recorded from three localities in all probability it existed in the county during the period in question. The remaining three species are presumably late arrivals in Essex, viz.:—*Helix aspersa*, *Vivipara vivipara*, and *Neritina fluviatilis*.

In considering those species, twenty-seven in number, which are quite unknown in a fossil state, it is perhaps better to exclude the whole of the slugs as well as the Brackish-water forms, thus leaving fourteen species. Of these four have been recorded from other Post-Pliocene beds: *Vitrea alliaria* from the Pleistocene of Ightham; *Balea perversa* occurs in the Pleistocene of Barnwell, and in a Holocene deposit at Crossness: *Sphærium rivicola* occurs in beds of both ages in the London District and *Pisidium nitidum* is found abundantly in old lake beds in Scotland. *Pyramidula rupestris* has been recorded from West Wittering, but as we have not seen the specimens we cannot say whether correctly or not. A single example of *Vitrina pellucida* is known from the Cromer Forest-bed, but no specimen of later date is known. The remaining eight species as yet unknown in a fossil state; they are: -

Vitrea glabra	*Limnæa glabra*
Helicella cantiana	*Sphærium ovale*
Hygromia fusca	,, *lacustre*
Helix pomatia	*Pisidium milium.*

Of course it is quite possible that some of these forms may yet be found preserved in some undiscovered deposit in this country, still as far as our knowledge goes at present they must be deemed modern additions to the fauna.

NOTE ON SECTIONS IN THE LEA VALLEY AT SOUTH TOTTENHAM.

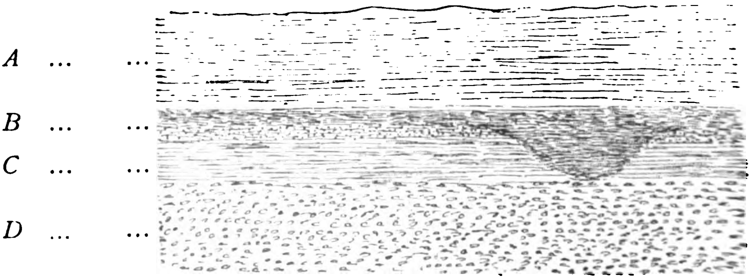
EXPOSED DURING THE CONSTRUCTION OF THE NEW RESERVOIRS OF THE EAST LONDON WATERWORKS COMPANY.

By T. HAY WILSON.

By the kindness of Col. W. B. Bryan, the Company's Engineer, Mr. T. V. Holmes and myself were in February last (1897) enabled to examine those sections left exposed during the construction of the large new Reservoirs, situated south of Tottenham Station, with the Lea River on their western side, and the G.E.R. Cambridge line on the east. The Lea bending here to the N.E. bounds the northern end. The reservoir made about two years ago is on the other side of the railway to the east, and the older reservoirs lie to the E. by N. of the last named.

The surface consists of clayey Alluvium and the lower layers of sand and gravel, forming the bottom of the reservoir. Intermediate beds of peat, shells, and loam occur, changing within a few yards. The average section where the peat occurs may be taken as follows:—

(Surface)	Clayey Alluvium - -	about	4ft. 0in. to 4ft. 6in.
	Peaty Band, with shells	,,	9in. to 12in.
	Grey Loam, with roots	,,	1ft. 6in.
	Sand and Gravel forming bottom, depth not ascertained.		



SECTION AT RESERVOIR IN LEA VALLEY AT SOUTH TOTTENHAM.

A, Clayey Alluvium; *B*, Peat with Shells; *C*, Grey Loam; *D*, Sand and Gravel.

Towards the Lea the peat bed became laterally simply a very dark brown clay band as the quantity of decayed vegetable matter diminished, and the section at this side consisted only of the clayey alluvium resting on the gravel. The consistency was fairly stiff and the colour light at surface, with the above-named dark band at the bottom. The loam is in some parts laminated with parallel bands of light grey three or four inches thick, and has the remains of numerous roots from former growth above. Traces of old channels occur as shown on annexed section. The shells are mostly broken, but are probably similar to those described by Dr. H. Woodward in vol. iii. of the *Transactions of the Essex Field Club* as found in the old reservoir in 1869.

In Whitaker's *Geology of London* (vol. ii., p. 41) Mr. W. B. Bryan has given the depth to the London Clay at one of the adjacent reservoirs as 22ft. 6in. The six-inch Ordnance Map gives B.M. 23ft. 6in. near the south end and 25ft. 2in. near the north.

[In a small quantity of material sent to me by Mr. William Cole, the few species of shells to be made out are:—

Vitrea cellaria
Helicigona arbustornm
Helix nemoralis
Limnaea auricularia
Limnaea stagnalis
Planorbis albus
Planorbis contortus
Bythinia tentaculata
Valvata piscinalis
Valvata cristata
Neritina fluviatilis
Sphaerium corneum

All these species have already been recorded for the Lea Valley deposits: see Messrs. Kennard and Woodward's paper in the present part of the Essex Nat., and the accompanying table.—Wilfred Mark Webb.]

THE GREAT STORM OF MIDSUMMER DAY, 1897.

[*With Map.*]

HAILSTORMS of considerable severity are by no means infrequent in Britain; a long list of such calamities could readily be compiled; but happily few are recorded in our annals equalling in destructive effects that which raged over Mid-Essex and in a small part of Bedfordshire on the afternoon of June 24th last[1]. In Essex within the present century two storms only can in any way be compared with it—namely, the hailstorm of July 14th, 1824, which did damage to the extent of £15,000 in the parishes of Hatfield Broad Oak, Takeley, Tilty, Canfield, Broxted, Stanstead, Elsenham, Little Easton, and Henham; and the hailstorms which commenced on July 11th, 1872, and continued in succession for three days, inflicting the greatest injury in the neighbourhood of Colchester, Tiptree, Messing, Easthorpe, Copford, Stanway, Lexden, &c.: the whole of the crops (valued at £10,000) on an area of 18,000 acres are stated to have been destroyed. But these historical storms sink into comparative insignificance beside our recent Essex disaster; when the flourishing crops of some of the most fertile part of Essex, growing on a band of country of perhaps 8 or 10 miles broad, extending from Epping through Ongar, Chelmstord, to Colchester, were in some places utterly, and in others partially, destroyed, while glass in greenhouses and window panes by thousands were smashed, and great destruction wrought on trees, wild and domestic animals and birds. As the *Times* special correspondent remarked, "A more delightful pictures of smiling plenty cannot be conceived than that which central Essex presented a few minutes before 3 o'clock on the Thursday afternoon. In less than 20 minutes the whole of that happy prospect was utterly destroyed, and the crops were as completely gone as with last winter's snow. It sounds incredible, but it is strictly and precisely true." Mr. Symons makes a low estimate when he writes that over about 100 square miles (one-fifteenth of the County) the prospects of harvest have been swept away. "Granting that over only half that area is there a total loss, it still means 32,000 acres, and putting it at even £3 per acre, it represents a loss of about £100,000. We have seen the amount put at more than double that sum." The number of birds killed was enormous, and in many districts there will be no shooting. Not only were young birds drowned, but old ones were struck dead by the hailstones. Cases are on record where wood-pigeons, crows, and other birds fell from trees as if shot by guns, with their heads split open by the falling ice.

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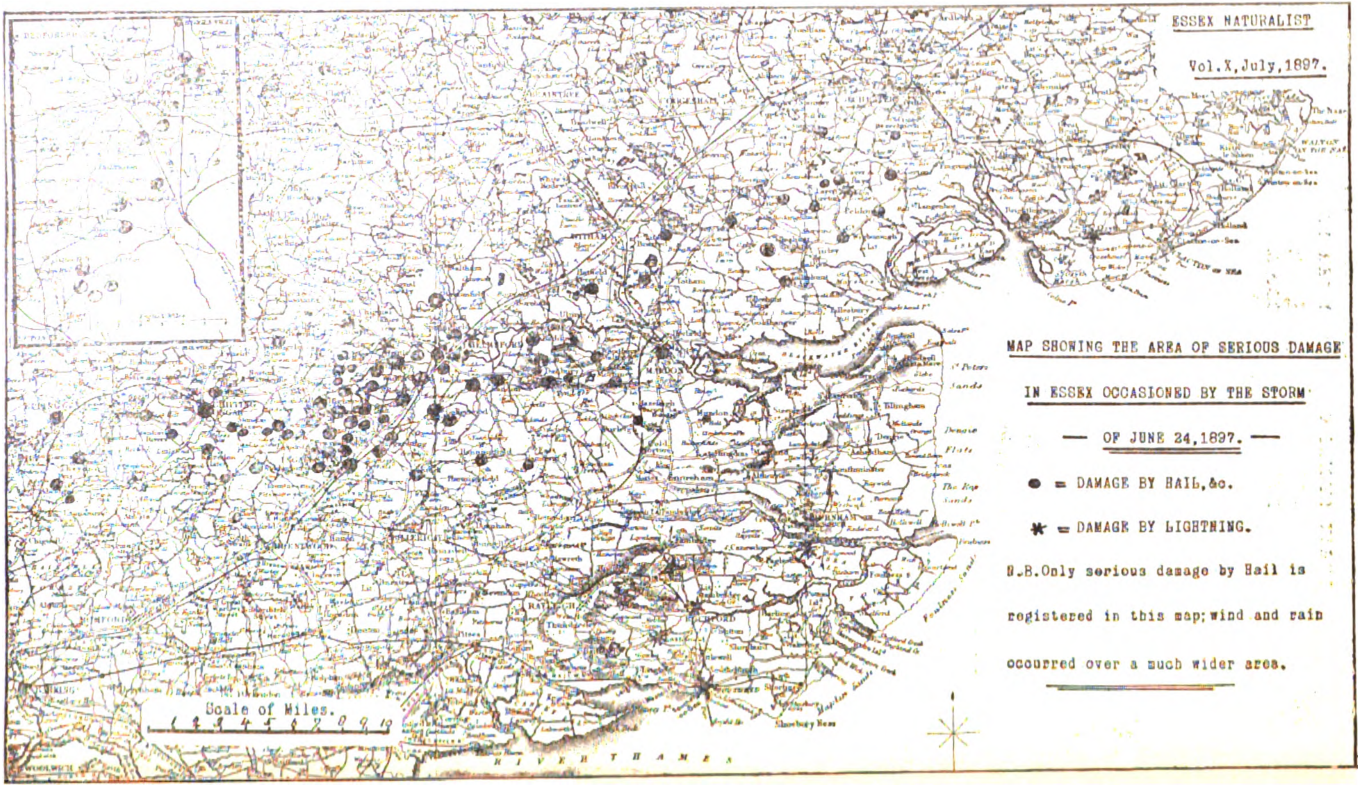
[1] But it is to be noted that the Bedfordshire storm may have had no direct connection with the Mid-Essex one; see *post.*

In compiling the following account of the tempest, we have to acknowledge great indebtedness to our esteemed *Hon. Member*, Mr. G. J. Symons, F.R.S., *Sec. Roy. Meteor. Soc.*, who has in the kindest manner permitted us to use the material contained in his paper in *Symons's Monthly Meteorological Magazine* for July. We have also used freely the many excellent narratives which have appeared in the local papers.

FIRST APPEARANCE AND PHYSICAL NATURE OF THE STORM.

The Sketch-Map accompanying this report shows roughly the course of the storm in Mid-Essex, the scenes of the greatest damage only being indicated. But at about the same time (3.30 or 4 o'clock) there was wreckage going on along a strip of Bedfordshire between Luton and Biggleswade, and the following account of a storm at Langford, near the latter place, has been published, and is quoted here as evidence of the destruction wrought in Bedfordshire :—

> "A terrific storm passed over this village on Thursday, June 24th, at about four o'clock in the afternoon. The lighting and thunder were not particularly severe, but the wind and hail were most alarming, and have caused sad havoc and loss. Such a storm has not visited this village since 1843. The crops have suffered terribly, wheat and barley being broken about half-way down the straw, and have already started to prematurely ripen. Onions have scarcely a particle of luke left on them, and turnip seed and beans are ruined. Many gardens are wrecked, the vegetables being badly cut, and the fruit stripped from the trees or so badly bruised that it will be of no service. In many cases the bark of the tree is so badly bruised and cut that in all probability the trees will die. A quantity of glass was broken, and a number of young fowls and ducks were killed. Numbers of dead rooks were collected from the fields next day. The hailstones were of enormous size and very irregular in shape, many resembling rough pieces of ice with sharp edges."


ESSEX NATURALIST

Vol. X, July, 1897.

MAP SHOWING THE AREA OF SERIOUS DAMAGE IN ESSEX OCCASIONED BY THE STORM — OF JUNE 24, 1897. —

● = DAMAGE BY HAIL, &c.

✱ = DAMAGE BY LIGHTNING.

N.B. Only serious damage by Hail is registered in this map; wind and rain occurred over a much wider area.

Mr. Symons is doubtful whether this Bedfordshire disturbance was directly connected with the storm in Essex—probably, it was not, so far as information yet extends—but we have indicated it on a small piece of map at the corner of the greater one.

The earliest Time Record of any disturbance on June 24th was a shower at Twyford (Berks) at noon. About an hour later there was a sharp thunderstorm with very large hailstones at Slough (Bucks), several buildings were struck with lightning and two cottages were burned down. At 1.30 p.m. a storm of hail, rain, thunder and lightning was raging round Uxbridge, Harrow, Stanmore, and Pinner. At 1.55 the wind carried away some garden frames at Willesden; at 2.6 the captive balloon from the Royal Botanic Gardens; at 2.45 it carried away a tent a little south of Epping, Essex; at 2.55 it was wrecking Ingatestone; it reached Chelmsford at 3, Danbury at 3.10, and died out, south of Colchester before 4 p.m. At Mr. Symons's own station at Camden Square, London, N.W., he records that the weather was hot in the morning, (87°·8 in the shade). Infact, he remarks, the special feature of the early part of June 24th was its high temperature. If anyone should write a complete memoir of the events of this day, one point to study would be the automatic records of temperature, in order to ascertain the precise time of the sudden fall in temperature, so as to find out whether it was a cause, or a consequence, of the storms. At 2h. 0m. 36s. p.m. a sudden strong gust of wind and sudden fall of temperature of 10°, calmer till 2.5, then very rough until 2h. 9m. No rain, lighting, nor thunder, but in the N.W. and N. a thick darkness covering everything. About 3 p.m. thunder, and thence till 6.16. p.m. lightning, thunder, and rain, but in a no wise exceptional degree. Later in the day, in North Surrey, Hampshire, and other adjoining counties, and along the East Coast as far as Hull, there were thunderstorms with short heavy rains. The space of country between Edgware and Epping appears to have been unvisited by any violent storm, and a like remark applies to a space S.E. of Witham.

Turning now to the storm as observed in Essex, it will be at once seen that it was remarkable for the enormous and most unusual amount of hail. Some of it was extremely large (hailstones of from 4 to 6 inches in circumference being commonly recorded), but in the opinion of Mr. Symons the mischief mainly came from the great strength of the wind, which gave to the hail the impetus and penetrative energy which its mere fall by gravity would not have done, and the evidence seems conclusively to show that the unusual ruin was the result of this joint action. He repudiates the title of "whirlwind" which has been applied by some to the storm, because he is unable to trace in the Essex phenomena the characteristics of a whirlwind—an approximately circular movement of wind rotating (vortex motion) and progressing, the motion being horizontal and the axis vertical—nor any signs of the expansion of confined air. The facts, Mr. Symons thinks, would probably fit in with the theory of a revolving storm of which the axis was horizontal. He has tracked hail-storms which seemed to support such an idea—say that of a monster steam roller passing along, but sometimes resting on the surface, and at intervals lifted above it, so that little injury would be there done. Observations in Essex seem to bear this theory out—we are told of adjacent fields, one wrecked and the other but little damaged. The short duration of the period of actual wrecking is also a fact of interest in connection with the theory.

GENERAL ASPECTS OF THE STORM.

The newspapers have given many narratives of the general effects of the storm, some of considerable graphic power—we select one from the *Essex County Chronicle*, entitled a "Tale of the Storm, by one who experienced it" This, we are told by the Editor, was taken down by Mr. Grant Conybeare, of Ingatestone, from the lips of a small local farmer :—

"I was standing here near the fireplace, when all at once my wife said, 'What a curious noise.' It was like a loud moaning, a long way off. As it gradually increased I knew it was a storm coming. All at once the fine gravel [illegible] in the yard seemed to be picked up and to fly up into the air in a cloud. Then it began to rain, big drops, and the noise and wind increased, [illegible] darkened by a cloud of leaves and twigs blown off the trees, then whole branches were blown past the windows. The noise gradually [illegible] the rain turned to hail; the hail becoming larger and larger [illegible] from view as if by a great white sheet, broken now [illegible] lightning, and the awful noise was increased by [illegible] only by shouting could we hear each other speak. [illegible] seemed to fly all over the house. Every [illegible] come down on top of us. As it gradually [illegible] in. When I opened the door for a few [illegible] The garden, which a few minutes before had [illegible] and everything seemed to have dis[illegible] were all shapes and sizes. Many of them were round, but lots looked like ice off a pond, which had been smashed up with a hammer and thrown about anyhow I have never before known what it was to lose nearly the whole of my crops."

In *Nature* for July 1st, Mr. Sheffield Neave, of Ingatestone, gives some extended and precise observations which call up a vivid picture of the great storm:—

"The 24th of June was an intensely hot day and after much distant thunder the storm broke on us about 2.45 p.m. (while haymaking was in full swing) from the N.W. After about ten minutes of the heaviest rain, hail began to fall, and soon a terrific hurricane, accompanied by hailstones larger than hen's eggs (mixed with others of all sizes downwards) came on and lasted for about five minutes, during which most of the damage was done. After this the storm gradually abated, and in something like half an hour had passed away. The scene was quite unique and winter-like. The ground was quite white, and in many places the hail had drifted to a foot deep, and every ditch and depression on the ground was full of water and hail. Every window on the north-west sides of the house and cottages was destitute of glass—not merely broken, but the whole driven through. Two greenhouses were completely smashed, only one pane in some miraculous way having escaped on the windward side A bird-cage hanging in a window was demolished, and the bird found on its back in a chair under a bit of glass. Rooks and pigeons were lying about in the fields dead and dying, and one of my men secured enough for a rook-pie next day Also we picked up next day some half-a-dozen small birds while turning over about eight acres of hay.

"A stable-roof covered by pantiles half-an-inch thick had half the tiles broken into quite small pieces, and has the appearance of having been shot at by rifles. Several chimney stacks had been blown on to the roofs, and in one case close by, through the house to the ground All the farm buildings and cottages were unroofed more or less

"Trees had fallen in quantity, either torn up by the roots or broken off in the middle. Branches had been twisted off everywhere and hardly a leaf remained; the neighbouring common was beaten down as if an army had stampeded over it.

"The crops presented a curious and melancholy sight The grass intended for hay looked as if a steam roller had been over it. The oats had also been not only beaten flat, but broken off short, and reduced to a sort of *long* chaff; in some cases the ends of a piece of stem stuck up, while the middle had been driven into the ground by a hail-stone

"The mown ground and the lawn were indented to a depth of one to two inches all over, much as if a flock of sheep had passed over them This was, of course, also seen on the flower-beds and mangold fields This last crop had also been destroyed to the extent of two-thirds, every leaf broken off, and often the root was in two pieces.

"A hedge at right angles to the storm and some wall-fruit were completely stripped of leaves and twigs, and left with [illegible] denuded of bark, not a vegetable remains in the [illegible] of greatest severity was very small and not in the centre [illegible] advancing front of the worst part seems to have been [illegible] width, and to have spent its greatest energy after a [illegible] little distance

"The hailstones were in appearance a conglomerate of smaller ones cemented together with ice, and generally the centre stone was bigger than the others. They were much collected together in corners, and one was measured, *24 hours after the storm*, four and a-half inches round."[2]

DETAILED ACCOUNT OF THE STORM IN ESSEX.

In the endeavour to give an account of the devastation within the districts which suffered most severely, we are met by the difficulty of the large number of records, and it will be necessary to make a selection, particular attention being given to those villages and districts in which the greatest damage occurred, and which are noted on the Map. We will take the villages in geographical sequence as nearly as may be, proceeding in a north-easterly direction from Epping and the Theydons, where the storm first made itself felt as an agent of destruction, to Colchester, near (or before) which town the tornado[3] appears to have died away into an ordinary but severe summer storm.

Epping and the Theydons. The storm passed over Epping about 2.45 p.m. The enormous hailstones did great injury to glass houses and windows facing the west. From the "Cock" hotel to Mr. J. G. Pelly's, scarcely a house escaped, and the hail lay on the houses like snow. At Gaynes Park the Jubilee dinner was washed from the tables and the tent almost carried away Hailstones fell fast and large and the villagers soon deserted the park in alarm. At *Theydon Garnon* 800 panes of glass in greenhouses went, chiefly facing west. Hailstones were an inch in diameter, and one was picked up at Birch Hall measuring 3 in. by 1½ in. Garden crops were practically ruined.

Ongar district. Here thousands of panes of glass were broken in greenhouses and private residences. At *High Ongar* alone, 8 or 10 trees were blown down, and *Ongar* was flooded; at the "Wilderness" 400 panes of glass were broken in the conservatory and house. Cattle were injured by being pelted by the hail, which drove them nearly wild. Some of the hailstones weighed nearly an ounce. Damage to crops in gardens and fields was very serious. About *Willingale Spain* and neighbouring parishes, the Rector says that some of the farmers will be ruined, so great was the destruction to the crops.

Abridge. The storm lasted from 2.45 to 3.30 p.m.; heavy rain; a tent was blown down.

Stanford Rivers. Burrow's farm, wheat and barley completely ruined. 40 windows smashed. At the Union-house, two or three hundred panes of glass were broken. At Mitchell's farm, loss estimated at £500.

Toot Hill. Widow's farm, crops ruined.

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[2] A large frame covered with tiffany, under which Mr. Neave was rearing entomological specimens, was whirled over the top of a cluster of shrubs 30 feet high, and carried to a distance of 60 yards, by the force of the wind.

[3] We use the word "Tornado" in the sense of a violent tropic-like storm, not as indicating any particular kind of tempest in the precise language of meteorological science.

Stondon. Halsford Bridge farm, root crops washed out of the ground and carried into a ditch. Damage done to field crops and gardens almost incalculable. Hailstones lay on the ground till Saturday afternoon. A dozen chickens killed by hail. At Woolmonger's farm 50 chickens killed, and at Paslow Wood Common 10 young turkeys and many chickens killed.

Kelvedon Common. At Brizes Park 900 panes of glass broken. Hailstones 2½ inches across.

Doddinghurst. In this parish of less than 2,000 acres, the Rector reported that an area of 500 to 600 acres of promising corn had been rendered absolutely worthless, and large and beautiful pieces of peas and other crops lay mangled and dying, being simply cut to fragments.

Ingatestone, Margaretting, Fryerning, Mill Green, &c. The scene here was one of almost universal destruction. In the words of the reporter of the *Essex County Chronicle*, " 'Desolation' is the only word that will convey any idea of the havoc effected by the tempest in the beautiful district of Fryerning and Mill-green. A walk or a drive through this stretch of country, which at mid-day on Thursday wore the greenest and fairest of summer dresses, is enough to produce the gloomiest of impressions. Corn crops of every kind are beaten almost out of recognition; the fruit and vegetables in gardens have suffered the same fate; glass in residences and greenhouses has been smashed on all sides; chimney pots have been blown down, and in a word, every kind of damage has been wrought. The destruction on the Common at *Mill-green*, where the golden furze grew in such wide extent and luxuriance, is something almost beyond belief, Not only have the trees hereabout been almost denuded of their leaves, but the bark on the hazel, the oak, and the gorse shrubs has been stripped off. The damage from fallen trees and branches even must be very great." It is quite impossible to particularize the damage except in a few instances. We have already given Mr. Neave's narrative (on page 117), but some other accounts are so graphic that we must find room for them. At *Ingatestone* Mr. Coverdale thus relates his own personal experiences:—" I was driving with my son and my coachman, a man name Gray. We had just got up to Mr. Kortright's house when the storm came on. We jumped out of the trap and hastened into the house. The storm descended without the slightest warning, except the blackness. First the hail and rain came down vertically, and then at a sharp angle. Down came the top of a tree at once. My man Gray—how he stood the storm I don't know—managed to get the cob under the sides of the house, and Mr. Kortright, my son, and I went out to try to assist. The hailstones immediately riddled the umbrella which I put up, and beat me back. The pony sustained a cut right down his nose. (This was a jagged wound about 1½ inches in length, and the pony's whole body was covered with lumps about the size of hen's eggs. A pailful of hailstone was gathered out of the trap). My man's chest and arms looked afterwards just as if he had had five minutes with a bruiser, they were discoloured everywhere and full of lumps. The force with which he was struck by the hailstones may be estimated by the fact that although he was wearing a mackintosh, livery coat, sleeved waistcoat, and shirt, he is black and blue. His tall hat was dented in. My son got a crack on the head through his hat, and there was a bump on his head in a moment as big as a hen's egg."

At Hardings farm and Hyde Park 40 large trees were uprooted, and 150 others broken. Nearly every private house was damaged, not merely the windows, but the roofs, and that often by overthrown trees. At Jordan's farm about 300 tiles were blown off. Mr. Arthur H. Raven says that he picked up one stone which measured 5½ inches round, and another which weighed (at the Post Office) 3½ ounces. At Lee farm the hail went through the slate roofing, and at *Mill Green Park*, twenty-four hours after the hailstorm the stones lay a foot deep on the N W. side of the house, and one taken up at haphazard measured 4¼ inches in circumference. The roof of Mr. Du Cane's house looked as if some one had gone along and broken the tiles with a hammer, and all three chimneys came down, one falling through the roof on to a bed.

At *Margaretting*, one lamb and several chickens were killed; Mr. Bright reported hailstones six inches round, and Mr. David Christy, of Margaretting Hall, thus relates his experience :—" I was on the top of that haystack when the storm broke. The wind blew away the poles and ladders, and there I had to stay! Two trees close to the stack were twisted and blown about to such an extent that I expected them to come down upon the stack every moment. One or two trees were blown down quite close to me, but I did not hear them, owing to the noise of the wind and hail. One of my old men (Cheek), who is of the same age as the Queen, was caught in the storm, and his arms and body were beaten black and blue by the hail. He has been in bed until this morning, unable to get up. Five other men took shelter under a tree, but when they saw a tree on each side of them blown down, they rushed into the open. Two of my horses bolted with a wagon which overturned into a ditch, and we had to take the wagon to pieces before we could get it out again."

A correspondent of the *Essex Weekly News* writes :—" The full effect of the hurricane can only be realised by a visit to the farms and a walk through the fields. In every instance it will be found that the barley stems are cut through; wheat stalks, being of a tougher fibre, are partly cut through, and the ears of corn are hanging down; and the mangel, swedes, and turnip crops are battered into the soil or, in the case of late sown, washed out. The grass crops are lying flat on the ground, and in most cases it will be necessary to allow the undergrowth to lift the crop before the mowing machine can be set to work. The pea crops are crushed into pulp; the bean crops are stripped of all foliage, and the pods knocked off; and the potatoes have the tops cut off just above the ground."

But the records of disaster in this devoted district alone would fill a dozen pages, and as personal observations are always the most valuable, they may be summed up in the words of Mr. J. L. Wharton, M.P., Chairman of the Central Chamber of Agriculture, in a letter dated July 28th :—

" On July 21st and 22nd I visited the area in Essex affected by the storm. I drove over about eleven miles of the most severely struck part of that area, and I can only say that I was astonished to see that a storm, lasting at the most twenty minutes, could have caused such terrible injury.

" It is certainly not too much to say that on the arable land I saw, there is no crop of wheat, barley, oats, or beans which will not cost more to remove from the land than can be repaid by any attempt to harvest it. The result must be that, as far as arable land is concerned, in the first place, the landlord's rent is gone for this year. The tenant has lost not only his crop, but also the cost of preparation, the cost of the seed, and the cost of the removal of the destroyed crop. The cottagers, with the exception of the potatoes, which were struggling—and somewhat successfully—to put up heads, have lost all vegetables in their gardens, and, unless they get harvest work elsewhere, will lose all their harvest wages as well.

"At Mill-green, about four miles from Chelmsford, the storm seemed to have been most violent. Fine old trees, oaks with large and widespread roots, had been uprooted, and lay in one particular spot like skittles in an alley at the end of a game. Four houses (two large ones) had the roofs (strong red tiled ones) entirely demolished on the windward side. In one case a large chimney stack had fallen through the roof, fortunately without damage to any of the inhabitants; and I was told that all the glass in the windows on the windward side had been entirely broken away and had been renewed. I should think that two thousand pounds would be a minimum cost of repairs to the four houses I looked at. A vinery in the garden of one of these houses had six panes of glass left out of about two hundred, and the vines inside were hopelessly damaged. The fruit trees—apples, &c.—were scored in the bark as if they had been shot; and the smaller fruit bushes—currants, gooseberries, &c.—had lost all fruit and all leaves. Fortunately, the hay crop is an excellent one, and, generally speaking, has been well got. This will in some cases save farmers from what otherwise (in default of assistance from outside) must mean absolute ruin.

"To sum up the situation, the result of this twenty minutes' hailstorm has been in the area affected:—

"1. Total loss to the landlord of the year's rent.

"2. Total loss to the tenants of the crop on arable farms.

"3. Loss to the labourers of harvest wages, damage to roofs, windows, &c., of their cottages, and (with the exception of potatoes) their garden crops."

Blackmore. At Sprigg's farm 30 trees were blown down, some of them being close together; one of them measured 4½ feet through the trunk, and tons of earth were lifted up by its roots.

When the storm broke, it caused two horses to bolt with a mowing machine, which was smashed up; and another pair ran away with a water cart. They knocked down three other horses, and the whole five rolled into a ditch in a heap.

A large barn, 60 feet long, was blown completely down; and during its fall a horse inside had a marvellous escape. When the wooden end bulged open, previous to collapsing, the animal sprang out and escaped without the slightest injury.

Some idea of the fury of the gale may be gathered from the fact that two men who were sheltering in a building immediately adjoining the barn never heard the barn fall, and were greatly surprised to find it down when they came from their shelter!

An examination of the crops revealed a complete state of ruin, the cereals being cut down, and the magnificent crops of old meadow grass battered about as if someone had been beating them with a rammer!

At Fringrith Hall was pointed out a peculiar result of the storm. It was a fallen ash tree, several feet in circumference, which stood in the centre of a belt of trees near the Hall. It was broken off about ten feet from the ground, whilst in an adjoining field the crop of corn was scarcely damaged.

Writtle. Mrs. Usborne reports a terrific storm here—hail, rain, lightning, thunder, and wind. "At 11 a.m. the shade temperature was 83°, and the air very oppressive; the storm so cooled the air that at 7.30 p.m. it was only 60°. At 3·3 p.m. there occurred such a storm of wind and hail as I had never seen. During the storm we could do nothing but listen to the hail smashing the windows, and it and the rain pouring into the house. The worst of the storm was soon over, but the rain continued till nearly 4 p.m., when I measured 1·42 in. At 4.10 p.m. I collected some of the stones and measured them; the largest I saw were 1½ inches by 1 inch by ¾ inch, and they did not melt till 6 p.m."

At Skegg's farm, Mr. Milbank said that he was out in the storm when his straw hat was cut to pieces, his arms, back, and head covered with bruises; four days after the storm there were bruises black and green 3 inches square. One of his men had his hat cut open by a hailstone, inflicting a wound on the head which had afterwards to be sewn up. The gale was so strong at this farm that a wagon with two tons of hay upon it was blown completely over; the windmill was so much damaged that it is of no further use. and will have the sails removed. Mr. Milbank had his crops utterly ruined, not an ear of corn left standing, and his neighbours are in the same sad plight. At Writtle Park, the residence of Mr. Burr, the quantity of glass broken was enormous, and a number of chickens were drowned.

Roxwell Mr. R. W. Christy reports from "Little Boyton Hall," that the rainfall was 1·34 in. "We were about 500 yards out of the main hailstorm, and did not get any wind, but a few very large stones and very heavy rain; the 1·34 in. fell in 30 minutes (timed). The lighting was overhead, 10 seconds time between flash and report approximately, but during the height of the storm the lightning and thunder were absolutely continuous, a fact which those in the middle of the storm could not notice." But the devastation immediately around Roxwell was reported as simply frightful, and the crops of wheat and other grain were almost totally destroyed.

Chelmsford. Chelmsford appears to have been about the centre of the storm, and the details of damage to houses and gardens quite defy any attempts at relation in a moderate space. We may take first a general description of the storm from the *Chronicle.* "The storm clouds began to gather overhead about two o'clock, and the atmosphere was singularly oppressive, the temperature being 88 degrees in the shade. By a quarter to three darkness prevailed to such an extent that it was necessary to light the gas in many houses and places of business. Immediately the storm began a scene was presented that has no parallel in local memory. Such occurrences are not unknown in tropical climes, but England, happily, does not witness them once in a century. The sky seemed a mixture of ink and fused copper, belching forth peal after peal of loud thunder, and putting all the Jubilee fireworks to shame with vivid tongues of electric flame.

"At the same time rain came down in torrents, and hail was literally shot out of the clouds. The hailstones were of an extraordinary size, some being as big as marbles and others the size of walnuts. A strong wind from the north carried the deluge with great impetuosity in a southerly and easterly direction, making it beat and rattle against roofs, walls, and windows with a fury that was terrifying. Windows facing the north and north-west were broken by the thousand, and in less than ten minutes, for about which space of time the stress of the storm lasted, the town of Chelmsford looked for all the world like a place that had been bombarded by a hostile army. So thickly was the air charged with the rain and hail that it was impossible to see across a street. The roadways were whipped up and the gravel and pebbles made to dance; wherever there was a weak place in a roof the storm found it, and water poured into rooms and down staircases; chimney-pots were hurled from their places; cellars were flooded, and the streets were turned into rushing and turbid rivers. Trees were stripped of their leaves, and some even of their branches, while flowers, and, indeed, all other things in gardens, were remorsely cut to pieces."

At "Melbournes" Mr. Rosling made the following observations:—"The storm began soon after 3.0 p.m., and came from S.W. Before it reached us it became very dark, and we could hear the roar of the storm as it approached then a few hailstones about the size of marbles; then the storm was upon us, with lightning, and in half-an-hour it was all over, but as we were in the track, windows and crops were almost totally destroyed." Dr. Thresh, at "Spergula," measured 1·14 in. of rain in 15 minutes, and Mr Chancellor's gauge in the High Street registered 1·37 in 20 minutes. At "Melbournes," near Chelmsford, Mr. Rosling measured 1·08 in. in 25 minutes, but as the hail would not be caught in the gauge he was unable to give the total amount. The hailstones were of various shapes, some globular, some oval, some oblong, some like sections of cylinders, and some exactly like small saucers, the edges resembling white lace, while the centres consisted of transparent ice, bluish in colour. Mr. Charles Pertwee picked up in the garden of "Claremont," London Road, two of the cylindrical shaped hailstones, which he found upon measurement to be five-eights of an inch thick, and one and one-eighth inches across. It seemed as if raindrops were congealed on the surfaces of the original stones. Mr. Rosling at "Melbournes" observed that the larger hailstones were 2 in. long by 1½ to 1¾ wide, and ½ in. thick. In Chelmsford High Street the hail actually blocked up many of the doors to premises. Mr. Pertwee had more than 200 squares of glass broken. The corrugated iron shed of Messrs. Hodge and Taylor, near the railway, was so riddled by the hail that it looked as if it had been shot at. About 25 sheets of the iron were pierced.

The reported damage fills two or three columns in the newspapers, and it will be sufficient to quote from Mr. J. B. Pash's account of the destruction wrought at the Essex Industrial School, as a sample of the scores of like incidents: "All the windows and doors on the west front of the large building used as a gymnasium were blown in and the roof carried off, portions of which were blown by the wind clean over the adjoining field into the field beyond, a distance of 530 feet, large sheets of iron going this distance. On the main building of the School a large chimney stack was blown down, masses of the brickwork going through the roof into the room below, destroying the furniture. Every window on the west front of the building was broken. The noise of the hailstones (some of which were an inch in diameter) can only be compared to the rattling of bullets from a troop of soldiers, and the hailstones were in such quantity that the ground adjoining was completely white, as after a heavy snowstorm, many of the hail stones remaining on the ground for over five hours afterwards. All the skylights over the swimming-bath were more or less destroyed." [4]

Great and Little Baddow, Galleywood and Sandon. The general features of the destruction to crops were similar in these districts to those already recorded elsewhere. The hail was remarkable. At *Great Baddow* all the windows with a western aspect suffered. Seventy diamond panes in an ancient window at the Church were broken; and at the Vicarage, Baddow-house, Pontlands, the Hall, Mascalls, and other principal houses much glass was shattered. The crops have also suffered considerably. At Cuckoo's Farm, *Little Baddow*, at 3 p.m., the hailstones were the size of a hen's egg—they smashed a stable window, and so pelted the horse that he nearly went mad; a stone struck a chicken dead at one blow. On Saturday (about 48 hours after they had fallen) Mr. Mecklenburg found in a ditch hailstones which weighed more than half an ounce.

Mr. C. Smoothy (Old Riffham's Farm, *Little Baddow*) says that the hailstones not merely came through his windows, but cut the blinds to shreds. After they had been lying some time, he measured one 6½ inches in circumference. Mr. Croxton was on a load of hay, near Byford's Mill, when the storm overtook him, and a "lump of hail, more than an inch across, struck me on the side of the head, denting in my straw hat and raising a lump on my skull. My head is sore yet." Mr. C. Smoothy reports:—"I am sorry to say that the storm here was very destructive to game. We picked up three old partridges, and several young, in a field adjoining my house, killed by the hail, evidently while brooding their young. Some of them were cut as if they had been struck by a bullet. From the severity of the storm, which lasted about half an hour, I am sure no birds could live in the open. This storm has killed hundreds. I am afraid that sportsmen will be greatly disappointed in September. Old birds as well as young must have been killed unless they were well sheltered by fence or wood. There were over 200 fowls killed in the village of Little Baddow."

At *Great Baddow*, six elms were blown down, four in one group. On Great Sir Hughes Farm the top was taken off a tree and dropped on to the lodge roof, bringing down the chimney and breaking the roof in.

Danbury. The appearance of Danbury village was such as one might expect it to present after a bombardment. On either side of the main road the cottages were in a dilapidated state. Most of the cottagers nailed sacks across their windows, for in some instances the frames were destroyed as well as the glass. All the crops suffered terribly. The poor people's gardens were wrecked. In one, the flower beds contained a mass of broken plant-stems and withered flowers; in another, of a more utilitarian character, what was evidently a prosperous crop of onions has been reduced to pulp, and in every plot, potato-bines lay broken and beaten down in their furrows.

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[4] In the words of the *Essex Standard* it is stated that "in various parts of the central district of Essex, some of the hail stones that fell on June 24 contained particles of a metallic substance. The phenomenon deserves investigation as suggesting a possible connection between meteoric dust showers and the formation of hail." In this regard it will be well to give (for what it is worth) the report of an occurrence which took place in Marriage's Square, New Street, Chelmsford, during the progress of the storm. "Mrs. Plaistow and two friends noticed, amid the crashing of the glass in the windows of the house, an appearance in the sky like a bright star, which shot across to the house, and scattered small pieces of stone of a flinty nature on to the carpets and rugs of the front rooms both upstairs and down. Upon examination these proved to be so hot that they could not be held in the hand, and numerous small holes were burnt in the carpet. In the house adjoining, occupied by Miss Eliza Holbrook, a similar occurrence was experienced, though not on so large a scale." (*Essex County Chronicle*).

Hailstones could be picked up as large as walnuts an hour after the storm had passed, though the thermometer stood at 80 degrees. At Fretton's nearly 200 panes of glass, and at the Palace 1000 panes, were smashed, about half that number being in the conservatories and greenhouses, and the rest in the mansion itself. The park was littered with branches of trees. Huge arms of oaks and beech lay on the ground in confused heaps, and here and there immense limbs, whose weight failed to force a passage to the ground, were held aloft on the out-stretched boughs of neighbouring trees. The permanent road way was greatly damaged, and was impassable for vehicles, owing to the falling of trees. Between one and two hundred panes of glass on the west front of the Church were destroyed, and the "Griffin" Hotel, which is on a rather exposed situation on the crest of the hill, had over 80 panes of glass smashed, At Major Rasch's house, he says that the hailstones were as big as marbles, and that 100 panes of glass were broken. At the Rectory stables, the hail cut right through the water spouts, on the side of an out-building. In several places the holes are the size of a three-penny bit, and one hole was a couple of inches in diameter.

The Rev. J. Bridges Plumtre, rector of Danbury, sends the following careful observations which he made at Danbury Rectory House, which was exposed, from its position, to the full fury of the storm: "At 3 p.m. the storm was travelling from the due West to this hill, accompanied by unusual darkness, vivid forked lightning and a rushing wind that came along in swirls and eddies rather than in one direct blast. At 3.4 p.m., rain began to fall; at 3.10 p.m. the wind was blowing a hurricane, and huge hailstones were hurled upon us; at 3.15 (about) the worst was over; at 3.30 p.m. the storm had passed. My rain gauge measured ·83 during the 26 minutes. I should like to observe that there were no hailstones in the funnel of the gauge when I examined it at 3.30 p.m., though the ground all round was strewn with them. (Diameter of gauge is 5 inches, height from ground 1ft.) Owing to the velocity of the wind, the hail fell at an unusually acute angle, but why none were in the guage I do not know. I weighed one of the hailstones, which was an average one of the larger sized ones, and it scaled ½ oz. Almost every pane of glass on the west side of the house was shivered, including a large sheet of plate glass."

Maldon. Mr. Thos. Isaac reports:—"The storm was not at its worst here. The hailstones were all rounded at the edges, and I think did not exceed half-an-inch in diameter. Hence, we had no broken windows, nor even frame or pit lights, nor was my garden much injured. Rain 1·12 in., the greater part of which fell in an hour. The lightning and thunder were very severe, being almost continuous throughout the hour that the storm lasted." But all parts of Maldon were not so fortunate as Mr. Isaac's neighbourhood. The *Essex Weekly News*' reporter stated that "large pieces of ice and hailstones larger than ordinary marbles fell and did considerable damage to the glass of many houses and to the crops of grass, &c., and fruit. The hailstones were of very curious formation, and many seemed as if they had been split from larger ones. Some measured three-quarters to one inch across and through. The High Street presented the appearance of a swift flowing river, and considerable damage was done to the roads on Cromwell-hill and Church-hill.

Several houses were flooded. One man who was driving some ladies had a new hard hat cut through in four places by the stones, while the ladies' umbrellas were riddled."

Layer Districts. Great damage is reported in these districts. At the "Donkey" beerhouse every pane of glass was broken, and at almost every dwelling-house in the village windows were smashed. At the Nonconformist Chapel, *Layer Breton*, about 100 panes were shattered, and the glass at a number of other buildings suffered considerably. The hailstones are described as being as large as walnuts. At *Abberton* and *Peldon* an enormous amount of damage was done to the crops, and a large quantity of glass broken. Very large hailstones fell at *Brightlingsea* and many windows were broken. At Abberton House the damage was very extensive. The same may be said of *Wigborough* and *Layer Marney*. At *Wigborough* nine chickens were killed by the hailstones.

Hatfield Peverel. Mr. Alfred Rosling, of "Cardfields," wrote that he was happy to say that his house was only on the outskirts of the storm, through Fairfields (another house on my farm) had 54 windows broken out of a possible 76. "The storm was preceded by a dense black cloud, travelling from N.W. to S.E., making it too dark to read, and the hail and rain began at 3.5, and at 3.25 the storm was over and the sun shining brightly, and in the 20 minutes I registered ·92 in. Some of the hailstones which fell at Fairfields were slabs of ice larger than the palm of your hand, and Mr. Edward Corder, of Writtle, told me that he measured one 4½ inches by 3½ inches which weighed 5 ozs." Other relations show that the storm was violent at Hatfield. Many panes of glass were broken by the hailstones, and several branches of trees were blown down, while leaves and twigs were spread like a carpet in every direction. The road between Hatfield and Chelmsford looked, in places, like the bed of a torrent, the gravel, its usual covering, being swept by the rain into banks at the roadside, leaving the stones bare. The damage done to fruit trees, &c., was very great.

Braxted. On Mr. Thomas Goodey's farm at Braxted the storm washed a heavy plough from one field over a hedge and about 300 yards into another field, and carried all the top soil of one field into ditches near by and completely filled them up, A brick wall, 14 feet long, was thrown down.

Kelvedon District. The storm was felt with considerable severity in this district. At the Britannia Company's Fruit Farm, *Tiptree*, a large quantity of the strawberries were reduced to a pulp by the hailstones, and the bush fruit was swept off. From 30 to 40 panes of glass were broken in several houses, but the smash was not so complete as in the great hailstorm of July 11th, 1872, when the same houses having south and south-east exposure were the chief sufferers. At Mr. Parish's, the greenhouses were completely smashed, and the seed crops practically destroyed. At *Tolleshunt D'Arcy* the storm did much damage and caused considerable alarm to the villagers. At *Wickham Bishops* a large number of windows were broken.

The tornado appears to have died out in great measure before *Colchester*, but at "Kings Ford," the residence of Mr. Horace Egerton Green, the Mayor, about three miles to the south of the town, the storm worked great havoc, ruining the kitchen garden and smashing a large quantity of glass, as well as doing other damage of an extensive character.

At *Lexden*, about a mile from the town, Mr. S. F. Hurnard records a very severe thunderstorm, but no hail. Total rain, 0·92 inches; and from *Ipswich* and *Norwich* we have similar reports.

DAMAGE BY LIGHTNING.

A good many records of damage by lightning are extant and many more where electrical discharges occurred without any remarkable injury resulting. The following may be set down:—

Burnham.—Two houses were struck but not much damaged.

Chelmsford.—A man struck in the Baddow Road; his hat was knocked off, and the upper part of his face grazed.

Colchester.—Chimney struck at the Ordnance Stores.
,, Mile End Church, roof and clock damaged.
,, Mount Cottage, Butt Road, chimney struck.

Ingatestone.—Harding's Farm, chimney struck and fell through roof.

Layer-de-la-Haye.—Oak tree struck.

Manningtree—Brantham Mill struck, but not ignited.

Rochford.—Market place. Roof of Mr. Ashby's house struck.
,, Eastwood. Several trees struck.
,, Mr. Bentall's chimney struck and fell through roof.

Southend.—Mr. Gomez, photographer, of Southend, was brushing his clothes near a mirror, when the glass was smashed to atoms by the lightning,

St. Osyth Priory.—Tower struck and clock stopped.

Wallasea.—Cottage near the schools much damaged.

Writtle.—Windmill struck.

CONFINES OF THE STORM.

At Ilford and Romford it was quite fine while the storm was raging, but at Brentwood rain fell heavily. At Buckhurst Hill and Woodford, darkness was experienced from 12.30 p.m. to about 2.30. No heavy rain fell until about 4 p.m., and between 4 and 5 o'clock vivid flashes of lightning with thunder occurred. No damage was done. A visit to Ambresbury Banks and Epping Thicks (a mile or so S. of Epping) on the following Saturday, proved that some hail had extended to that part of the forest, as leaves and twigs thickly strewed the ground. The fringe of the storm extended to South Weald, where it interrupted the Jubilee festivities. At Wickford Lieut.-Col. Kemble (Runwell Hall) records:—"A little rain and some hail fell about 3 p.m., but it amounted only to 0·03 in., so that the storm cannot be said to have reached here, in fact, the damaged trees along the road hence to Colchester show that the limit was about four miles N., in which direction, and notably over Ingatestone, it was very dark."

At Rayleigh, Hadleigh, Hockley, Benfleet, and Canvey Island quite a whirlwind was experienced whilst the storm lasted, but only trifling damage was done and very little rain fell. At Burnham the storm was somewhat severe, at Southminster it was very slight. Very little hail fell below Mundon (where it killed some young ducks) and no damage was done to the crops. Round Southend, with the exception of Rochford and Paggle-sham, the damage was slight. The hailstorm was heavy in the town, but on the Pier no hail fell to speak of.

On the West there was thunder, hail, and rain (total 0·61 in.) at Broxbourne. Northwards the effects of the storm were felt very lightly in the Braintree and Dunmow districts, but the lightning was exceptionally vivid and the thunder heavy. Mr. H. S. Tabor, F.R. Met. Soc., writes from "Fennes," Braintree:—"We were about 15 miles N. of the zone of greatest intensity. Distant thunder at intervals from about 11 a.m., 2—3 p.m., thunder remarkably continuous and gradually louder. 3 p.m. thunder and lightning sharp, when nearest about one mile distant. Rain, a smart shower, no hail, ·02 in. Damage, none."

And finally as we have said above, the ***hailstorm*** seems to have practically died out a little before Colchester, although heavy thunder and rain extended to Ipswich and Bury St. Edmunds, Suffolk.[4]

Such is the record of the black Thursday in June, 1897. The tale is somewhat tedious and painful, but the details we have given will have considerable historical and possibly scientific value and may enable our readers to realise with some vividness the disastrous effects of this remarkable tempest. The total value damage to crops and property is not yet, and perhaps never will be, known, but competent judges, consulted by the Inspector for the Board of Agriculture, estimated it at about £200,000. We are glad to say that strenuous efforts are being made to afford substantial relief to the sufferers, without which many of them must be absolutely ruined. The Lord Mayor has started a "Mansion House Fund," and a County Fund, under the Chairmanship of the Lord Lieutenant, Lord Rayleigh, has been opened, and together the funds at the time of writing amount to about £37,000. The County Relief Committee is now engaged in investigating the facts as to damage in various districts, and their report may be expected to present features of considerable interest. In the meantime all will sympathise with the philanthropic side of the good work thus undertaken, and we beg to call attention of all our readers to the announcement of the County Fund printed on the wrapper of the present part of the Essex Naturalist.

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[4] It would be useful to have full and systematic records of the rainfall on June 24th. from as many localities as possible. We shall be very glad to receive such for registration in a future part of the E. N.

THE ESSEX FIELD CLUB.

FIELD MEETING IN EPPING FOREST.

Saturday, April 10th, 1897.

THIS Meeting was mainly for the observation of the Fresh-water Algæ and the Mosses, and was under the direction of Mr. E. D. Marquand (of the Royal Herbarium, Kew), who was one of the conductors at a similar meeting in March last year. We had also the pleasure of the company of Mr. H. Fisher, Naturalist to the Jackson-Harmsworth Arctic Expedition. The incidents of the meeting call for no special remark; a most pleasant ramble was taken from Theydon Bois, through the Theydon Thickets, Genesis Slade, and St. Thomas's quarters, plants and insects being noted. At about six o'clock tea was taken at the "Wake Arms," and afterwards an Ordinary Meeting (the 168th) was held, Prof. R. Meldola, Vice-President, in the chair.

Mr. Marquand then delivered a lecture, intended as an introduction to the study of the Fresh-water Algæ, of which a full abstract will be published in the next part of the Essex Naturalist.

Mr. Marquand's lecture was illustrated by diagrams and specimens, and the Secretary exhibited some large diagrams of Freshwater Algæ presented by Dr. Cooke, as well as the copy of Dr. Cooke's fine work on the Freshwater Algæ of Britain, recently presented to the Club by Prof. Meldola.

A short discussion ensued, and Mr. Marquand was cordially thanked for his interesting address.

The members of the party then made their way to Theydon Bois or Loughton Stations, *en route* for home.

FIELD MEETING AT HOCKLEY AND RAYLEIGH, ESSEX.

Saturday, June 19th, 1897.

Conductor: T. V. Holmes, Esq., F.G.S. *(Vice-President).*

A very delightful meeting was held on this afternoon, under Mr. Holmes' direction, and a goodly number assembled, in spite of the deterrent fact that it was the eve of the Jubilee and many members were bent on seeing the troops march through the East End. The members travelled by the G. E. Railway, arriving at the village of Hockley at about 1.20 p.m.

The object of the excursion was to give members of the Club an opportunity of seeing a part of Essex hitherto unvisited, and the scenery of which is unusually picturesque. The physiography of the neighbourhood is shown in the Map illustrating Mr. Holmes' "Notes on the Ancient Physiography of South Essex" (ESSEX NATURALIST, Vol. ix., pp. 193-200). As regards geological structure, this district consists of London Clay, above which, at Hockley, Rayleigh, and Hadleigh, there is an outlier of Bagshot Sands, on which, again, there are patches of old High-level Gravel. Consequently the ground on which those places stand, is of unusual elevation, and commands very fine views.

At the Station the party was welcomed by the Rev. R. C. M. Rouse, Rector of Rayleigh, who very kindly placed his carriage at the service of some of the ladies, and who accompanied us the whole afternoon, giving in the pleasantest way all the local information in his power.

On leaving Hockley Station the building of classical aspect still known as Hockley Spa, and which was once the Pump Room, comes into sight, a few yards away on the road towards Rayleigh. Hockley Spa had a considerable reputation for its mineral water in the early years of the Victorian era. The waters were first mentioned in this connection by Dr. Benjamin Allen, of Braintree, in the 2nd edition of his book, *The Natural History of the Chalybeat and Purging Waters of England*, &c. (1711), but their celebrity mainly arose from the sinking of a well in the garden of a Mr. and Mrs. Clay (*circa* 1840), who "had determined upon building for themselves a cottage in this elevated region, they having escaped the relaxing and weakening effects of a long residence in Cheltenham." Soon the waters were puffed by the fashionable medicos of the day, and a detailed account of the well and the supposed medicinal virtues of the waters is given in Dr. A. B. Granville's *Spas of England, 1841*. But the fashion of "taking the waters" has died out, and for many years the Pump Room has been unused for its original purpose, though the "Spa Hotel," erected at the same time as the Pump Room, is still an inn. Mr. Holmes quoted a few remarks from Mr. Whitaker's *Geol. of Lond. and part of the Thames Valley* on the Spa and the local geology; and Mr. F. Hughes, F.C.S., gave a verbal report of his analyses of the water, which were not then completed.

[A full account of the history of the Spa and of the chemical nature of the Hockley waters, by Mr. Hughes and Mr. Cole, is reserved for a future number of the ESSEX NATURALIST, when Mr. Hughes' experiments shall have been completed.]

Leaving the "Spa," which in its present condition presented by no means a cheerful and festive aspect, the party walked along the road to Rayleigh as far as the "Bull Inn," and then turned northward towards St. Peter's Church. The views northward along the route are very fine and were much enjoyed, the low narrow water parting between the valleys of the Crouch and Blackwater being visible between the higher ground of Althorne on the east and that between Woodham Ferrers and Purleigh on the west And nearer, southward of the Crouch, was seen the site of the famous battle between Edmund Ironside and Canute, known as that of Assandun, or Ashingdon. In one of the most elevated of the fields, along the pleasant paths of which we were strolling, Mr. Holmes gave an address on the physical geography of the land, its geological features and some notes of the history of the spot in Saxon times. Mr. Holmes illustrated his remarks with a large series of geological maps, and the facts recorded in them could be admirably demonstrated in the wide landscape before our eyes. Naturally the most interesting historical event was connected with Ashingdon, where in 1016 Canute obtained his great victory over the Saxons. Traces of an encampment are there, and also some barrows near. Mr. Holmes read the following extract from Freeman's *Hist. of the Norman Conquest* as an historical commentary on the scene:—

"The Danes meanwhile sailed along the coast of Essex, and entered the estuary of the Crouch. There they left their ships, while the army went on a plundering expedition into Mercia, which is spoken of as being more fearful than any that had gone before it. After this they returned towards their ships, the latter part of their course leading them along the high ground which lies south of the Crouch. Along these heights Eadmund followed them, and at last overtook and engaged them in the sixth and last battle of this wonderful year, the memorable fight of Assandun. At the extremity of the range, two hills of slight positive elevation, but which seem of considerable height in the low country in the east of England, look down on the swampy plain watered by the tidal river. Between the hills and this lowest ground lies a considerable level at an intermediate height, which seems to have been the actual site of the battle. Of the two hills, one still retains the name of Ashington, an easy corruption of the ancient form; while the other, in its name of Canewdon, perhaps preserves the memory of the Danish conqueror himself. On Assandun, then, a site marked by entrenchments which are possibly witnesses of that day's fight, possibly of yet earlier warfare, Eadmund drew up his forces in three ranks, and at first seemed disposed to await the attack of the enemy. . . . But Cnut had no mind to attack; probably he wished to avoid a battle altogether, and merely sought to regain his ships with his plunder. At all events, he had no mind to attack the English as long as they were posted on a spot where the ground gave them the advantage. . . . He gradually led his troops off the hills into the level ground: that is, the intermediate height between the hills and the swampy plain. The main object of Eadmund was to cut off the Danes from their ships; he had therefore no choice but to leave his strong post and to descend to the lower ground. . . . He accordingly began the battle with a furious assault upon the Danes . . . and the fight was kept up with equal valour and with terrible slaughter on both sides. But, on the whole, the Danes had the worst, and they were beginning to give way, when Eadric again betrayed his lord and king and . . . took to flight. The battle, however, was kept up till sunset, and even by the light of the moon; but after the flight of Eadric, the English had to maintain the struggle on very unequal terms. All England fought against Cnut; but Cnut had the victory."

A short rest was taken at St. Peter's Church, which is traditionally said to be the original church built by Canute in memory of his victory. It occupies high ground, and there are pleasant views from the church-yard. Mr. E. B. Ferry, in the *Archæological Journal*, vol. 31, p. 47, has the following remarks on this church:—

"I have examined Hockley, as well as Canewdon, in the search for Saxon work. It is impossible, however, to tell the date of the masonry, for the whole has been so entirely plastered over outside that not a vestige of the real surface of the walls is visible. On the south side of the chancel is a window built of a material resembling the Reigate fire-stone. The stones are very small, less than ordinary, and the inner order [? border] of the window appears to have been cut away to allow of the insertion of new glass. The church has a north aisle, separated from the nave by an Early English arcade, with elegant foliated caps formerly plastered over, but restored to view again some thirty years since. The west tower doorway had been elaborately cusped, and once had a finial on the top, but is now in a dilapidated condition; it appears to be of Decorated date."

Owing to some mistake, we were unfortunately unable to enter the church. By the way, it always strikes the lay mind as singular that some churches should be kept securely locked up. Judging from experiences in very many places, the doors may be safely left on latch—a goodly custom to be followed. A shut-up church is such an anomaly in a Christian land! and, further, is a grave detriment and grievous discouragement to those who, like the present writer, always make for the old ivy-clad church in coming to a strange village, as presenting in its crumbling walls and antique monuments the best epitome of the historical associations of the place :—

> "I love the ever-open door
> That welcomes to the house of God!
> I love the wide-spread marble floor,
> By every foot in freedom trod!"
>
> JOHN KENYON.

Mr. Holmes and Mr. Rous then led the party by an enchanting series of bye-paths and field-paths, commanding extensive and varied views, and affording much entertainment in the rich and abundant flora. In one field the rare and beautiful Grass Vetchling *(Lathyrus nissolia)* was not uncommon. In another we found plenty of the elegant Quaking-Grass *(Briza media)*, and plenty of the Yellow Rattle *(Rhinanthus crista-galli)* in seed. The hedgerows were of a very mixed nature, and the cursory view we had of the country gave us a high opinion of its richness as a field for botanical exploration. Of the insects we cannot speak, as there were practically none—we but repeated the experience that everyone has obtained of this otherwise charming summer—from some cause, in Essex, at least, during the summer, insects are unusually scarce. At Rayleigh village, at the invitation of the Rector, we visited the Church (Holy Trinity), which is of flint and stone, and chiefly Perpendicular. There is a grand Tudor porch, partly ivy-clad. In the south-chapel is a fine Decorated carved altar-tomb of the 14th century. The Rector also conducted the party over his pretty garden, in which are some very fine trees.

Tea was taken at the "Crown Hotel," Rayleigh, and an ORDINARY MEETING (the 169th) was afterwards held, Prof. R. Meldola, F.R.S., *Vice-President*, in the chair.

The following were elected members of the Club :—

Miss M. E. Atkins, *West Ham High School*; Mr. Gerald Buxton, J.P., *Birch Hall, Theydon Bois*; Rev. W. Claxton, M.A., *The Vicarage, Navestock*; Mr. Dennis Coales, *King's Head Hill, Chingford*; Mr. Cecil Schwartz, *Ivy House, Woodford Green*; Mr. S. Arthur Sewell, F.R.H.S., F.R.G.S., *Maplestead, Palmerston Road, Buckhurst Hill*; Dr. H. C. Sorby, LL.D., F.R.S., F.L.S., &c., *Broomfield, Sheffield*; Mr. H. B. Yerburgh, *Frampton, Epping*.

Prof. Meldola announced the fact that the bronze Statue to the late Sir Richard Owen, F.R.S., who had been one of the Hon. Members of the Club, had been placed in the Hall of the Natural History Museum. The Club had been one of the subscribers to the Fund (*see* "Notes").

Prof. Meldola also announced that the Countess of Warwick had invited the Club to Easton Lodge on July 21st.

Mr. Cole exhibited living larvæ of the Coast Lackey Moth *(Clisiocampa castrensis)*, and made some remarks on the habits of the moth and its occurrence on the East Coast (*see* "Notes").

A cordial vote of thanks was passed to Mr. Holmes for the trouble he had taken in arranging and conducting the meeting.

The party then walked to the "Castle," immense earthworks, covering in all about 11 acres. The principal part is an artificial (or more probably partly artificial) oval mound, divided into two parts, one being nearly 100 feet above the bottom of the outer ditch, and surrounded by embankments and ditches. It is one of the largest earthworks of the kind in Essex, but absolutely nothing beyond a few vague (and probably erroneous) statements in the pages of our early histories is known of it. A summary of these records, with sections and a view of the earthworks, was published by Dr. Laver in the *Trans. Essex Archæological Soc.*, vol. iv. (N.S.), pp. 172-178, and some further remarks on the supposed history and origin of the works from the pen of Mr. J. H. Round appeared in vol. v., pp. 41-43. At the top of the highest mound (upon which had been reared an immense bon-fire to be lighted on the Jubilee night) Mr. Holmes demonstrated the salient features of the fortification, and read the substance of a paper entitled "Notes on Ancient Defensive Earthworks in connection with those of Rayleigh Castle." This paper will be published in the next part of the ESSEX NATURALIST. According to Murray's *Handbook*, Rayleigh Mound was examined "about 50 years since," when it was proved that about 20ft. of the height consisted of made soil. No masonry was found. Both Mr. Holmes and Dr Laver arrive at the conclusion that Rayleigh was a British Oppidum, but they do this by very different lines of reasoning.

The view from the mound was so fine and extensive, and the interest taken in the earthwork was so great, that only the near approach of 7 o'clock induced the party to descend the hill to the railway station, to catch the last train to London, and discuss on the way the incidents of a very pleasant and profitably spent afternoon.

THE PROTECTION OF WILD BIRDS IN ESSEX.

EXTENSION OF THE CLOSE TIMES UNDER THE WILD BIRDS PROTECTION ACTS, 1880—1896, AND THE PROTECTION OF SHORE BIRDS.

IN an article on this subject in the ESSEX NATURALIST last year (vol. ix., page 256) it was intimated that the County Council then intended making application to the Home Secretary for important extensions of the Close-time for Wild Birds in Essex. We are glad to say that these applications have been granted, and the operation of the Acts is now modified in a very noteworthy way.

For the reasons set forth in the above-named article, an Order of the Secretary of State was issued by the Clerk of the County Council on the 31st of May, 1897, prohibiting the taking or killing of any "Wild Bird" *between the 15th day of March and* *the 15th day of August (both inclusive)* in any part of the County of Essex under a penalty of £1 for every bird so taken or killed, *and for refusing to give his name and place of abode when desired by any person who may discover him committing the offence, a further penalty of 10s.* It may be well to give the list of birds scheduled as "Wild Birds" under the above Order; we quote the official names of the birds without alteration—it will be noticed that some species are mentioned more than once under different appellations[1]:—

American Quail—Auk—Avocet—Bee Eater—Bearded Tit (Reedling or Reed Pheasant)—Bittern—Bonxie—Buzzard—Colin—Cornish Chough—Coulterneb—Cuckoo—Curlew—Diver—Dotterill—Dunbird—Dunlin—Eider Duck—Fern Owl—Fulmar—Gannet—Goatsucker—Godwit—Goldfinch—Grebe—Greenshank—Guillemot—Gull (except Black-backed Gull)—Hobby—Honey Buzzard—Hoopoe—Kestrel—Kingfisher—Kittiwake—Lapwing—Loon—Magpie—Mallard—Marrot—Martins *(Hirundo urbica, Hirundo riparia)*—Merganser—Merlin—Murre—Night Hawk—Night Jar—Nightingale—Oriole—Osprey—Owl—Oxbird—Oyster Catcher—Peewit—Petrel—Phalarope—Plover—Ploverspage—Pochard—Puffin—Purre—Razorbill—Redshank—Reeve or Ruff—Roller—Sanderling—Sandpiper—Scout—Sealark—Seamew—Sea Parrot—Sea Swallow—Shearwater—Shelldrake—Shoveller—Shrikes *(Lanius collurio, Lanius minor, Lanius excubitor)*—Skua—Smew—Snipe—Solan Goose—Spoonbill—Stint—Stone Curlew—Stonehatch—Summer Snipe—Swallow—Swift—Tarrock—Teal—Tern—Thicknee—Tystey—Whaup—Whimbrel—Widgeon—Wild Duck—Willock—Woodcock—Woodpecker—Wryneck (Cuckoo's Mate or Snakebird).

Under the above-named Acts, the EGGS of the following species are protected within the Metropolitan Police District area, and the penalty is £1 on conviction for every egg taken or destroyed:—

Nightingale—Goldfinch—Lark *(Alauda arvensis, Alauda arborea)*—Nightjar—Woodpeckers *(Gecinus viridis, Picus major, Picus minor)*—Kingfisher—Cuckoo—Owls *(Asio otus, Strix flammea, Syrnium aluco)*—Kestrel—Buzzard—Honey Buzzard—Merlin—Hobby—Osprey—Wryneck (Cuckoo's Mate or Snakebird)—Swallow—Martins *(Hirundo urbica, Hirundo riparia)*—Swift—Bearded Tit (Reedling or Reed Pheasant)—Shrikes *(Lanius collurio, Lanius minor, Lanius excubitor)*—Magpie—Wheatear—Stonechat—Whinchat—Redstart—Flycatchers *(Muscicapa grisola, Muscicapa atricapilla)*—Sedge Warbler—Reed Warbler—Blackcap—Garden Warbler—Wood Warbler—Willow Warbler—Chiffchaff—Whitethroat—Lesser Whitethroat—Long-tailed Tit—Nuthatch—Wren—Golden-crested Wren—Wagtails *(Motacilla viridis, Motacilla lugubris, Motacilla melanope, Motacilla raii)*—Hawfinch—Linnet—Buntings (*Emberiza rustica, Emberiza melanocephala, Emberiza citrinella*)—Starling—Landrail or Corncrake—Coot.

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[1] These schedules are in other ways very vexatious and ineffective. If *all* birds cannot be protected (and wherefore not?), surely, as Mr. Collinson has said, the right principle would be to enumerate just those species which are outside the pale of protection, not those which are within it.

And now we have to call attention to a very important Order issued by the Home Secretary. It is to the following effect :—

"Any person who between the Fifteenth day of August in any year and the Fifteenth day of March following shall within that portion of the County of Essex which is within the *Metropolitan Police District* or *the parishes of Epping, Epping Upland, Theydon Bois, Theydon Garnon, and Lambourne*, shoot or attempt to shoot, trap, snare, net, or otherwise take any Wild Bird or shall have in his possession any Wild Bird recently killed or taken and included in the Schedule hereunder written shall on conviction forfeit and pay for every such Bird the penalty provided by the said Acts."

SCHEDULE REFERRED TO.

Nightingale—Goldfinch—Lark—Nightjar—Green Woodpecker—Great Spotted Woodpecker—Lesser Spotted Woodpecker—Kingfisher—Cuckoo—Barn Owl—Tawny Owl—Long-eared Owl—Short-eared Owl—Kestrel—Buzzard—Honey Buzzard—Merlin—Hobby—Osprey—Wryneck (Cuckoo's Mate or Snakebird)—Swallow—Sand Martin—House Martin—Swift Bearded Tit (Reedling or Reed Pheasant)—Shrikes—Magpie—Wheatear—Stonechat—Whinchat—Redstart—Flycatchers—Sedge Warbler—Reed Warbler—Blackcap—Garden Warbler—Wood Warbler—Willow Warbler—Chiffchaff—Whitethroat—Lesser Whitethroat—Long-tailed Tit—Nuthatch—Wren—Golden-crested Wren—Pied Wagtail—Yellow Wagtail—Grey Wagtail—Hawfinch—Linnet—Common Bunting—Snow Bunting—Landrail or Corncrake—Coot—Chaffinch—Tree Creeper.

Inasmuch as birds are by the County Order protected between March 15th and August 15th, it follows that within the area mentioned (which includes the whole of the Epping Forest district) ALL THE BIRDS IN THE SCHEDULE ARE PROTECTED ALL THE YEAR ROUND. And a similar Order has been made for the County of London. Taken in connection with the effect of Mr. Buxton's "Epping Forest Bird Protection League" (see E.N., vol. ix., pp. 49-50, and vol. x., pp. 56-57) and the protection afforded by the Conservators, *our Forest is now the best protected area in England*. We can but repeat our wish, however, that, in this district, ALL BIRDS WITHOUT EXCEPTION could be protected, for the reasons stated in a former article (E.N., ix., p. 257-8), which experience convinces us are yearly becoming more cogent.

Finally, in February last, the Order for the Shore Birds, which arose out of a Petition presented by the Essex Field Club to the County Council (set out on page 44 of E.N., vol. ix.; see also Mr. Russell's article in E.N., vol. ix., p. 218, and report on pp. 255-56), and which had been sanctioned by the Home Secretary in the previous year, was issued by the Clerk to the County

Council; and to render the story complete, we print the important parts:—

"Any person who shall take or destroy, or incite any other person to take or destroy, the eggs of any Wild Bird [*i.e.*, any bird mentioned in the schedule], in the undermentioned area; shall be liable, on conviction, to a Penalty of not exceeding One Pound, for every egg so taken or destroyed.

THE AREA ABOVE REFERRED TO.

"The whole of the Foreshore, including the shingle, sand hills, salt marshes, creeks, and other uninclosed lands extending from highwater mark to the first boundary of enclosed or cultivated lands separating the foreshore from them, between the following points on the coast, viz.:—

"From Harwich Lighthouse to Shoeburyness; such parts of the tidal river Blackwater as are above the Town of Maldon, such parts of the river Colne as are above Wyvenhoe, and such parts of the river Crouch as are above Battles Bridge, being excepted from the said area."

Attention is now being directed to the decrease of many of our rarer insects and plants, and an important discussion on this subject (including also the question of the preservation of mammals and birds) took place at the meeting of the Club at Lady Warwick's seat, Easton Lodge, near Dunmow, on July 21st. We must defer the report of this discussion until the next part.

BORING IN SEARCH OF COAL IN ESSEX.

GREAT WAKERING SELECTED AS THE SITE FOR THE THIRD TRIAL BORING.

ON June 1st a meeting of the Eastern Counties Coal-Boring and Development Association was held at Ipswich, to decide upon the site of the third trial boring. The following is an abstract of the Report which the Directors submitted to the Shareholders. A great deal of information on this interesting and important problem will be found in previous articles in the ESSEX NATURALIST, vols. viii. and ix.. and in the present volume, *ante* pp. 9-10:—

"When the last annual report was issued the Weeley Boring was in progress and had gone down 622 feet. This boring was continued to a total depth of 1,221 feet 6 inches, but your Directors regret to state that no signs of coal or other minerals were discovered during the progress of the boring.

"The following is a section of the Bore-hole from the surface [with the corresponding boring at Stutton, Suffolk, for comparison]:—

	Weeley Boring.	Stutton Boring.
London Clay (with a little soil at top) ..	125	80
Reading beds	71	
Upper, Middle, and Lower Chalk	822½	874½
Gault	76	49½
Old Rock (Grey, most fissile, dipping at a great angle, containing no fossils, possibly Silurian and almost similar to that found at Stutton)	127	521
	1221½	1525

"The consulting geologists to the Company have made frequent visits to the boring at Weeley during the progress of the work, and have carefully examined the cores brought up from time to time. A conference was arranged between them and the Directors at Weeley on December 17th, 1896 [see vol. ix., pp. 253-255, and *ante* p. 254], and after an inspection of the cores and hearing the report by Messrs. Whitaker and Holmes, your Directors unanimously decided to suspend operations at Weeley without going to any further expense over the matter.

"Since the abandonment of the Weeley boring your Directors have been in constant communication with the consulting geologists to the Company regarding a site for the third boring, and these gentlemen have advised them that a site for the third boring should be found somewhere in the neighbourhood of Shoeburyness or Great Wakering, in the South-Eastern corner of the County of Essex.

"The landowners in the vicinity of the selected district have been approached with a view to the acquisition of a site for the boring above-mentioned, and your Directors have to report that they have succeeded in getting a favourable and convenient site on the estate of Mr. E. A. Wedd, J.P., at Great Wakering, Essex. A provisional agreement has been entered into with Mr. Wedd which gives the Association rights over 1,300 acres, and secures to it one-half of the profits arising from the working or sale of sale of coal or other minerals for a period of 30 years from the date of the agreement.

"Your Directors, however, before making final arrangements to sink the boring on the site chosen, have decided to ascertain the opinion of the Shareholders on this matter, as the district selected is somewhat out of the area originally suggested as the sphere of the Company's operations. Your Directors are unanimously of the opinion that they must be guided entirely by the advice of the geological experts, who have recommended the district above mentioned; but they feel that an opportunity ought to be afforded the members to express their opinion as to whether the district selected meets with their approval or not."

At the meeting the Chairman, Mr. G. Calver Mason, pointed out that, as stated in the report, the boring at Weeley had been completed. The geologists advised them that nothing would be gained by going further, the character of the rock for the last hundred feet or more showing, in their opinion, that it was below the Carboniferous strata. With respect to the suggested boring at Great Wakering, an important point for discussion arose in the fact that this site was altogether out of range of the district in which the funds for exploration had been raised. The greater portion of this money was subscribed in the county of Suffolk, and of course the reason many people subscribed was rather from the commercial idea that if coal were discovered the neighbourhood would get the benefit of the discovery, than for the purpose of purely scientific research. Under these circumstances, the Directors felt that they were not justified in spending money in the district selected without the consent of the Shareholders. It was also pointed out to Messrs. Whitaker and Holmes that it would be very desirable, if possible, to make the third boring in the neighbourhood of Bury St. Edmund's, because, at the meeting held in that town when the money was raised, the question was asked whether they could not afterwards make a sinking thereabouts, and the answer was that they certainly would do so if the result of other experiments led them in that direction and the geologists advised them to make the attempt. The reply of the geologists was that they had examined the cores taken from the deep well-boring on Lord Cadogan's estate at Culford, near Bury St. Edmund's, Suffolk, and had found that the rocks there reached were almost identical with those which had since been found at Weeley and Stutton. They also said, with reference to the rocks got out at Harwich some time ago, that they had examined some specimens which were recently unearthed from a private collection in London, and had formed the opinion that they were not Carboniferous after all, but very similar if not exactly identical with those found at Stutton and Weeley.[1] Having the results of four borings—at Harwich, Culford, Stutton, and Weeley—it might practically be said that they had swept that part of the country and found no coal. It was a well-known fact, furthermore, that there was no coal to the west of London, in Hertfordshire. On the other hand, they had the fact that coal was now found in workable quantities, and very successfully worked, in the neighbourhood of Dover. The upshot was they were advised that the south of Essex afforded the best chance of finding that continuation of the Belgian coal fields with those of the West of England, for which they had all along been looking, and, as above stated, Great Wakering had been selected for their third experiment.

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[1] Mr. Mason is here referring to the somewhat doubtful fossil which Mr. Prestwich thought to be contained in the dark slaty rock, from below the Gault, at Harwich, and which led him to believe that this slaty rock was of the Lower Carboniferous age. Mr. W. W. Watts has recently subjected this supposed fossil to microscopical examination, and has been thereby led to pronounce it to be merely a peculiar fracture in the rock, and to refer the Harwich rock, on lithological grounds, to some formation older than the Carboniferous—probably Upper Silurian, and similar to that found at Stutton and Weeley. It will be remembered that Mr. Holmes stated in his report in 1894 (E.N., viii., p. 145) that the boring "at Harwich ended in beds apparently older than the Coal Measures."

Ultimately the report and agreement were unanimously approved, and the Directors were authorised to proceed with a third trial boring at Great Wakering, according to the advice of the geologists. We shall report the results in due course.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

AVES.

The Golden Orioles at Bowers Gifford.—Referring to the note in the last part of the ESSEX NATURALIST (*ante* p. 60), it may interest you to know that the two Golden Orioles were again seen in Bowers Gifford on July 17th. They were seen by Mr. Williams' manservant on a tree in the hedgerow about a couple of hundred yards from the Rectory. He told me he saw them quite distinctly, so that there is no doubt of the fact. I am glad they have escaped the snare of the fowler so long, and I only hope that this safety may be prolonged after the close time for birds terminates.—(Rev.) HENRY HASTED, The Rectory, Pitsea

Golden Orioles in Epping Forest.—Last summer I received information from two sources of a bright yellow bird about the size of a thrush having been caught sight of in the forest, and on each occasion it was in the district between Monkwood and Debden Green. On the 29th of April in the present year my sister had a good view of one in Lord's Bushes, and she has no doubt of the bird being the Golden Oriole.—F. W. ELLIOTT, "Mark Ash," Buckhurst Hill.

Long-eared Owl (*Asio otus*) Breeding in Essex.—Mr. E. A. Fitch writing to the *Zoologist* for May, says:—"While walking through Pheasant-house Wood, Little Baddow, with my boys on April 15th, I noticed an owl flit noiselessly out of a large Scotch-fir; seeing a squirrel's dray or old crow's nest, one of my sons made an inspection, and soon disturbed the other owl. The nest contained two eggs. We again saw the owls on the same tree on April 23rd, so trust they may be successful in bringing off their brood. In Christy's *Birds of Essex* (p. 155) we read 'I never actually heard of its breeding in the County, except at Harwich, though it has probably done so elsewhere.'"

PISCES.

The Essex Fisheries.—The Inspectors of Sea Fisheries report that during 1896 the weather was most unfavourable at Harwich for all fishing, excepting for shrimps and lobsters. The quantity on the whole was below, but the quality above, the average. Prices have at times ruled high on account of the small catches. Fishermen complained of the bad cod season. Large quantities of shrimps were caught, but prices were rather below the average; cod and lobsters were rather above. During the latter part of the season the catch fell off very considerably, owing to the weather. Seven first-class boats, 34 second, and 20 third belong to the station, but a much larger number were engaged in the fishing.

In the Stour (Essex and Suffolk) District it is reported that a large quantity of small fish have been observed, and preservation has been of value. Like success has not been achieved in the Orwell.

At Brightlingsea trawling inshore for flat fish was an average alike as to quantity, quality, and price. Oysters, mussels, scallops, and whelks were an average, whilst sprats and shrimps were below the average. Weather was against sprats. Forty first-class boats, 65 second, and 10 third belong to the station.

At Burnham the general condition of the several fisheries was good, and that for oysters very good, the weather having been generally favourable to their culture. Very large quantities of "spat" are reported to have been produced, and to be in good condition. Prices of oysters have been very much lower than in the previous year.

The oyster fisheries about Colchester and Burnham are reported to have been very good, and the fall of "spat" to have been abundant in some places. The past winter seems to have been favourable to the cultivation of oysters, and few were lost through severe weather. As the English markets have lately been considerably injured by the rumours of typhoid poisoning from eating oysters, the prices obtained by fishermen have been much lower than usual.

The grantee of the Hanford Water and Paglesham Orders again reports that nothing has been done with respect to the first; and his statement with regard to the second shows that the fishery was still used merely as a store-ground for oysters bred elsewhere and placed here only temporarily. He adds, however, that there was a "fair spat in some parts." Eight hundred and sixty-six thousand three hundred oysters were sold from the Tollesbury and Mersea fishery, realising £6,810 10s.; and 1,530,742 brood taken by local dredgermen on the adjacent public grounds, and bought from them for £2,542 7s. 6d., were laid down on the grantees' beds; besides 300,000 "half-ware,"[1] bought from local merchants and dredgermen, at a cost of £941 5s. Besides spat, the stock on the grounds at the end of the season was estimated at 3,000,000 oysters and 4,000,000 "half-ware," the whole being valued at £35,500.

The returns rendered by the Roach River Oyster Fishery Company under the provision of the Sea Fisheries Act, 1868, show that 508,800 oysters were sold last year for £3,099 9s. 8d., while 2,295 bushels of "brood," "half-ware" and "spat" were laid down, the whole of which were derived from the Company's own pits and grounds. A "favourable fall of spat" in 1896 is reported, and the growth is stated to be strong.

INSECTA.

LEPIDOPTERA.

Saturnia carpini in Essex.—A female example of the Emperor Moth was brought to me by Mr. A. J. Furbank a few weeks ago, which had been caught in the Ongar Road, Chelmsford. The handsome caterpillars of this species occurred in some numbers on the raspberry canes at Tiptree Heath last year.—W. M. W., Brentwood, July, 10th 1897.

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[1] "Spat" is the young oysters in their motile stage, or very early in their attached stage; when a little more mature they are called "brood"; while "half-ware" and "ware" are oysters still nearer the marketable size.—Ed.

The "Coast Lackey Moth" *(Clisiocampa castrensis)*.—The caterpillars of this moth have been noticed in astonishing numbers on the Essex coast this spring; often many thousands could be counted in a few square yards. The moth is very interesting to Essex naturalists, inasmuch as it is only found in Britain by the shores of the estuaries of the Thames and Medway, feeding on salt-marsh plants. Abroad, the species is distributed widely, and is not restricted to salt-marshes, but is found in woods and heaths, feeding on oak, birch, blackthorn, and some low-growing herbs. This is by no means a solitary instance of remarkable dissimilarity of habitat in Continental and British insects of the same species—for instance, *Papilio machaon* is with us confined to marshes, while on the Continent it is found in gardens and fields everywhere.—Ed.

COLEOPTERA.

Trap for Beetles.—According to Mr. Warburton, "Zoölogist" to the Royal Agricultural Society, a plan for trapping Wire-worm Beetles (Elateridæ) has been tried on a farm in Cambridgeshire, and in the United States with much success. Some clover was placed under a tile in a barley field in Cambridgeshire infested with the beetles, and within a fortnight 65 were captured and destroyed. Assuming half to have been females, it is estimated that the production of 900 wireworms was thus prevented. The clover continues to attract the beetles after it has become quite dry. The experiment is not only interesting to farmers and gardeners, but may afford a useful hint to the collectors of some tribes of plant-eating beetles.

MOLLUSCA.

Colchester "Native Oysters" at Gloucester in Roman Times.—Mr. Eliot Howard, in the course of an interesting letter to the Editor on the recent discoveries made in the tracing out of Glevum Colonia by the acumen and skill of Mr. John Bellews, writes:—"The mention in the Essex Naturalist for last quarter of a 'Colchester native of the time of Constantine the Great' suggested to me that it might be interesting for the Museum to possess some 'native' shells of an even earlier date." Mr. Howard sends specimens of the oysters, and after referring to the completeness with which Mr. Bellews has identified the positions of Roman Gloucester, he continues:—"At certain parts of the wall, outside where the officers' 'quarters' would be, are found heaps of *native* (Colchester) oyster-shells, whereas the common soldiers were content with local bivalves (probably obtained from the Mumbles). This brings up the interesting fact of the rapid communication that must have existed between the two fortresses at one time forming the two ends of the military line held by the Romans as the limit of their effective occupation—as, later, the 'walls' in the north held back the still more turbulent Caledonian tribes. It would seem that the Romans always held the country by a quadrilateral of fortresses, and in Mr. Bellews' opinion, when Glevum was in its prime and Camalodunum was the opposite corner, the quadrilateral was completed by Chester and Lincoln."

BOTANY.

PHANEROGAMIA.

Abnormal Flowers of Lychnis and Chrysanthemum.—Mr. Willament has recently brought to me two abnormal flowers found by him in the neighbourhood of Brentwood. One was a seedling of the Red Campion (*Lychnis diurna*), and here the sepals had grown at the expense of the rest of the plant, and approximated to foliage leaves ; the other was a collection of some four or five inflorescences of the Oxeye Daisy (*Chrysanthemum leucanthemum*), which were fasciated and joined throughout their length, while the stalk of another one adhered to the fasciated stalks for some distance above the ground, and then becoming free, shot away, so that its head of flowers overlopped the compound mass by some inches.—W. M. W., Brentwood.

Primula elatior in Britain : its Distribution, Peculiarities, Hybrids, and Allies.—At the meeting of the Linnean Society on June 17th—the last meeting of the past session—Dr. A. Günther, F.R.S., President, in the chair, Mr. Miller Christy, F.L.S., read a lengthy paper on the above subject, in which he stated the results of his observations on this plant since the appearance of his paper "On the genus *Primula* in Essex" in the *Transactions of the Essex Field Club* in 1884 (vol. iii., pp. 148-211).[2] He remarked that this widely-distributed Continental plant, though figured accidentally in *English Botany* in 1799, was not really detected in Britain till 1842, when it was found at Great Bardfield, in Essex, by Henry Doubleday, of Epping. Up to that time, the totally distinct Hybrid Oxlip *(P. acaulis* × *veris)* was, by British botanists, confused with and mistaken for it, as is still frequently done. In Britain, *P. elatior* occupies a very sharply-defined area, lying chiefly in the north-west part of Essex, the south-west part of Suffolk, and the south-east portion of Cambridgeshire. This area is divided into two portions by the valley of the River Cam, that portion lying to the east of the valley being by far the larger of the two. There were only two outlying localities, so far as Mr. Christy could ascertain. The two portions of this area cover the two most elevated and unbroken portions of the Boulder Clay district, the loams and gravels of the river-valleys and the Chalk being entirely avoided. The boundary-lines (some 175 miles in length) which had been traced by Mr. Christy with precision were, in consequence, very sinuous. They enclosed together about 470 square miles, over which area the Oxlip flourishes in immense abundance in all old woods and some meadows; while the Primrose (which grows all around) is entirely absent. Along the dividing line between the two, which is very sharply defined, hybrids are produced in great abundance. On the other hand, the Cowslip (which grows both around and throughout the Oxlip-area) very rarely hybridizes with it. Mr. Christy believed that the Primrose was, in this counrry, gradually hybridizing the Oxlip out of existence. He then noticed a rare single-flowered variety of *P. elatior*, which (if thought to be of varietal rank) he proposed to call var. *acaulis*, and several aberrations, showing upon the screen photographic views of these and of the hybrids, as well as a map of the distribution of the Oxlip in Britain. In a discussion which followed, Mr. C. B. Clarke, F.R.S., and Sir John Lubbock, Bart., M.P., said that, so far as their own observations went, they confirmed the accuracy of Mr. Christy's remarks.

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[2] See also a paper "On the Range of the Primrose (*Primula vulgaris*) and the Bardfield Oxlip (*P. elatior*) in North-Western Essex," by Mr. J. French, with additional remarks by Mr. Christy, in the ESSEX NATURALIST (vol. v. pp. 120-124), where some further details are given.

PALÆONTOLOGY.

Uphall Farm, Ilford.—We regret to learn, from announcements in the newspapers, that Uphall Farm, a classic spot for geologists, will shortly be sold for building purposes. It was here that the late Sir Antonio Brady unearthed his magnificent collection of Pleistocene animal remains which is now in the British Museum of Natural History. The Club had the benefit of visiting the Ilford Elephant ground under the direction of Sir Antonio Brady, Mr. A. R. Wallace and Mr. Henry Walker, in July, 1880 (Proc. E.F.C., vol. i., pp. xxviii.-xxxviii.), when the former pointed out the spots where he obtained the bones of the lion, the mammoth's tusks 11 feet in length, and other gems in his collection, and he also expressed the opinion that there were plenty more specimens in the soil for future explorers. The Uphall pits and their fossil treasures are fully described in Mr. Walker's paper, "A Day's Elephant Hunting in Essex," which formed one of the first publications of the Club. A second visit to the spot was made in 1893 (E N,, vol. vii., pp. 92-95). If the place is to be built over, we hope that care will be taken to preserve any specimens found during excavation, particularly small things like Mollusca, &c,, which are now of such special interest to geologists. The property includes the "Uphall" or "Barking Camp" described by Mr. Walter Crouch in the ESSEX NATURALIST (vol. vii., pp. 131-138). This Camp has never been properly explored, and it is now threatened with destruction. Can nothing be done. if it cannot be rescued, at least to gain some correct idea of its period and constructors, before Uphall is devoured and desecrated for ever by the rabid speculative builder?—ED.

MISCELLANEA.

Queen Elizabeth's Lodge in 1853.—The following reference to the Forest and to Queen Elizabeth's Lodge occurs in the first volume of *The Story of my Life*, by Augustus J. C. Hare (G. Allen, 1896). Written in 1853, the letter, which was addressed to his adopted Mother on March 13th, may be regarded as of quite respectable antiquity:—

"Yesterday afternoon I went with Papillon to take leave of the Forest. It was a perfect day; such picturesque lights and shades on the Edmonton levels. We went through Chingford churchyard, and then through the muddy forest to the old Hunting Lodge, which I had never reached before and felt to be the one thing I *must* see. It is a small, gabled, weather-beaten house, near a group of magnificent oaks on a hill-top. Inside is the staircase up which Elizabeth *rode* to dinner in her first ecstasy over the defeat of the Spanish Armada. Afterwards, I suppose because she found it easy, she had a block put at the top from which she mounted to ride down again. To prove the tradition, a pony is now kept in the house, on which you may ride up and down the stairs in safety. The lodge is still inhabited by one of the oldest families of forest-rangers, who have been there for centuries: in a room upstairs are the portraits of their ancestors, and one bedroom is surrounded with tapestry which they declare was wrought by the Queen's own needle.

The touch about the Spanish Armada is pleasant, and the pony, so far as I am concerned, is a new feature in the picture. Perhaps some one remembers making in his own person an experiment from which Mr. Hare, schoolboy though he was, seems to have shrunk. But stay—I am forgetting that he tells us he never had any pocket-money, even after he had arrived at years of more than discretion.—W. C. WALLER, Loughton.

The late Sir Richard Owen.—It will be remembered that in 1893 the Club subscribed £3 3s. towards the Fund then being raised to place a statue of the late Director in the British Museum of Natural History, Sir Richard having been one of our Honorary Members, and having on several occasions shown great kindness and courtesy to the Club. We are now informed by a circular dated June 3rd, 1897, signed by Sir Wm. Flower and Mr. W. Percy Sladen, that the "work inaugurated at the meeting held in the rooms of the Royal Society on the 21st January, 1893, under the presidency of H.R.H. the Prince of Wales, K.G., has been completed. The bronze statute of the late Sir Richard Owen, executed by Mr. Thomas Brock, R.A., is now placed in the hall of the Natural History Museum. It is pronounced by all who were personally acquainted with the great anatomist to be an admirable likeness, and worthy of the position which it occupies. . . . . The Numidian Marble pedestal has been provided by the Trustees of the British Museum." The fund raised amounted to £1,103 8s. 11d., and the very numerous and eminent names in the list of subscribers testifies to the estimation and reverence which the name of Owen must ever bear among men of science.—ED.

Harwich as a Port of Entry.—It is not natural history, but it is worth noting as a fact not generally known that Parkeston stands fourth on the list of English ports for the value of its imports—those above it being Hull, Liverpool and London. The value of the total *imports* unloaded at Parkeston last year was £18,104,132, the figures for the four previous years being:—1895, £17,024,480; 1894, £16,602,539; 1893, £16,147,491; 1892, £16,299,014. The total value of the *exports* of home produce and manufactures was £3,401,118, against £3,630,807 in 1895, £3,845,749 in 1894, £3,405,209 in 1893, and £3,258,702 in 1892.

South-Eastern Union of Scientific Societies.—The Second Annual Congress of this Union was successfully held, at Tunbridge Wells, on Friday and Saturday, 21st and 22nd of May, under the Presidency of the Rev. T. R. R. Stebbing, F.R.S. (who delivered an admirable address), and the skilful and energetic secretarial care of Dr. Abbott. Several papers and discussions, interesting to all members of Natural History Societies, were read, among which may be noted the following:—"What can be done to save our Fauna and Flora from unnecessary destruction," by the Rev. J. J. Scargill, B.A., and A. Rose; "How can the Technical Education Grant assist Local Scientific Societies," by S. Atwood and J. W. Tutt, F.E.S.; "Local Museums," by William Cole, F.L.S., E.F.C.; and "The [illegible] of Field Clubs," by Prof. G. S. Boulger, F.L.S., E.F.C. Our friends in Kent, Surrey and Sussex are setting a good example—how long will it be before we follow suit in East Anglia? The Report of the Congress may be had from Dr. G. Abbott, 2, Queen's Road, Tunbridge Wells, Kent, price 1s.—ED.

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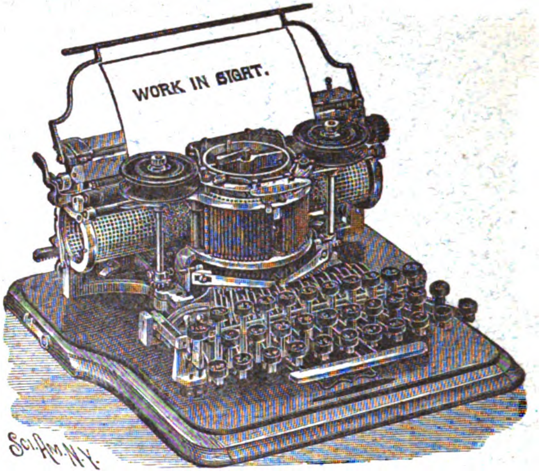
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OF THE

ESSEX FIELD CLUB.

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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THE

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A CONTRIBUTION TO

The Natural History of the County.

(Forming Volume iii. *of the "Special Memoirs" of the Essex Field Club).*

BY

HENRY LAVER, M.R.C.S., F.L.S., F.S.A., etc.,

Of Colchester; Vice-President of the Essex Field Club, and Senior Surgeon to the Essex and Colchester Hospital, Colchester.

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NOTES ON ANCIENT DEFENSIVE EARTHWORKS IN CONNECTION WITH THOSE OF RAYLEIGH "CASTLE," ESSEX.

By T. V. HOLMES, F.G.S., F. Anthrop. Inst. (*Vice-President*).

[*Read at the Meeting on July 10th, 1897.*]

SITES for ancient castles or camps possessing any considerable amount of natural strength are very rare in the Eastern Counties. For the Chalk, which abounds in strong natural positions in Kent, Surrey, Sussex, Hampshire, Wiltshire and Dorset, occupies very little of the surface of Norfolk, Suffolk and Essex, being generally covered in the last-named counties by the Chalky Boulder Clay and other superficial beds. And where the Chalk does appear, mainly on their western borders, it is much less bold in outline than it is on the North and South Downs and elsewhere south of the Thames Valley.

If we turn our attention to the positions of the defensive earthworks on the Chalk of the Southern Counties, we find that we may expect to see an ancient entrenchment wherever there is a strong natural site. Indeed, my own experience is that they invariably go together, but exceptions doubtless occur here and there. If we follow the course of the Chalk escarpment (or outcrop), we notice spots where combes, or natural hollows along the face of the steep hillside, almost isolate a few acres of land from the high ground adjacent, and find that the high ground thus isolated has been converted into a primitive stronghold by means of a rampart and ditch, which are most developed where the ground is weakest. Sometimes more than one rampart and ditch surround the fort, as in that magnificent example, Maiden Castle, near Dorchester, and in other cases. These hill forts are by no means confined to the Chalk *escarpment*, but are to be found wherever a nearly isolated hill appears. Thus, in Sussex, the Devil's Dyke, near Brighton, a very steep combe, nearly isolates a fort on the edge of the Chalk escarpment ; while Cissbury Camp, north of Worthing, is about midway between the Chalk escarpment and the sea. And others, at Seaford and Beachy Head, have the Chalk cliffs for their southern boundary.

A curious point with regard to the distribution of these defensive earthworks on the Chalk is the extreme irregularity of the interval between each camp and its nearest neighbour. And this point is the more noteworthy, as whether they stand on the North or South Downs, on Marlborough Downs, or on Salisbury Plain, there can have been little, if any, diminution of their original number. Whatever may have been the case in other districts, man has been under no temptation to level the ramparts and fill up the ditches of the primitive fortifications on the Chalk of the Southern Counties. Sheep now feed in and around them as did those of the camp constructors many centuries ago. Last year, at the end of May, I walked round Yarnbury Castle, on Salisbury Plain. A shepherd came up and led his flock into the deep fosse of the old hill-fort, as the only place, in that very dry season, where the grass was both green and fairly long. And the ramparts now, as formerly, afford most welcome shelter from sun and wind both to sheep and shepherd. It is extremely satisfactory, therefore, to be able to note their distribution without feeling that the camps now existing are but accidental survivors of a large number which have been destroyed in the name of agricultural improvement, and which, did they now exist, would entirely alter our views as to their distribution in prehistoric times.

As an example of the irregularity of their distribution, I cannot do better than note that prevailing on the north and north-western edges of Salisbury Plain. From Devizes eastward, for about 18 miles, the Chalk of Salisbury Plain is separated from that of Marlborough Downs by the Vale of Pewsey, the Upper Greensand forming the surface in the Vale, which is well-populated and well-wooded, and contrasts in every way with the bleak, bare Chalk downs to the north and south. Looking along the escarpment for ancient camps on the southern, or Salisbury Plain, edge of the Chalk, we find none between the eastern end of the Vale of Pewsey and Upavon, a distance of 10 miles. But a mile-and-a-half S.W. of Upavon is Casterly Camp. Then, west of Casterly Camp, Bratton Castle appears, about 14 miles from Casterly, and two from the town of Westbury. Turning southward from Bratton Castle, we find on the Chalk escarpment east of Warminster, and within four miles from Bratton, two large camps, Battlesbury and Scratchbury, only a mile apart from each other, overlooking the Upper Greensand vale. Many other examples might be given, but any one interested in the matter will be able to supply them for himself with the aid of ordnance maps.

The distribution of these Chalk camps, their presence where naturally strong positions exist, and their absence where they do not, seem in themselves, apart from other evidence, to point to the conclusion that they are the work of a primitive people grouped into independent tribes or clans which inhabited adjacent districts. Their wars were with each other, hence they had no plan of defence on a broad scale. And their tools were so rude and inefficient that, having to deal with the comparatively hard Chalk, they were compelled to economise labour by taking the utmost advantage of the work of natural agencies, even though it might often result in great inconvenience as regards the positions of their forts. I need not here dwell upon the general absence within these earthworks of any provision for a good supply of water, or to other considerations which all point to the conclusion that they were simply intended to be camps of refuge in which the women and children, flocks and herds of a tribe could remain secure for a day or two during the raid of some hostile clan or of piratical invaders.

Popular tradition, in giving names to some of these old camps indicating the time of their supposed origin, has tended to lessen rather than to magnify their antiquity. Perhaps the most remarkable example of this is Cissbury, which instead of being, as its name would imply, the work of the South Saxon King Cissa, has been shown by General Pitt-Rivers to date from the Stone ages. In other cases the name "Cæsar's Camp" has been applied to ancient hill forts both on the Chalk and on other rocks, as with that on the Bagshot Sand at Aldershot; with the entrenchment in Holwood Park, Kent, on the edge of the Lower Tertiaries; or with the camp on the Chalk escarpment at Folkestone. But in all such instances, as in the above examples, the name has been, in all probability, given in consequence of the discovery, within and around their areas, of Roman remains, the name "Cæsar" being applied as that of the most famous of all Romans, who is also known as having visited South-eastern Britain. In Northern Britain there has been a corresponding tendency to suppose Agricola to have been the builder of large numbers of Roman camps.

The Romans and more recent invaders of Britain seldom occupied permanently the sites of these hill-forts, though Roman soldiers probably garrisoned some of them for short periods before the district had thoroughly accepted Roman rule, or during local disturbances afterwards. Though the Romans were by no means indifferent to strong natural positions for their camps, they did not value them as places of refuge, but as means of keeping order in a district; as centres for repelling pirates from their shores, not as places of security from their attacks. Positions like those of Reculver, Richborough, Chichester or Colchester were strong enough for them, if suitable in other ways. Of course, where a primitive hill-fort was advantageously situated, from the Roman point of view, it was utilized, as in the cases of Dover and Old Sarum: but they were generally ill-placed for Roman purposes. Though the Romans occupied permanently the site of Dover Castle, their nearest station westward was not where the so-called "Cæsar's Camp" stands on the lofty Chalk escarpment north of Folkestone, but on low ground close to what was then sea at Lymne, west of Hythe.

On crossing the Thames into Essex we find ourselves in a district in which there are no strong sites for hill-forts comparable to those on the Chalk in Kent and Sussex. For the surface of Norfolk, Suffolk and Essex consists almost entirely (as I have already remarked) of strata much softer and less coherent than the Chalk. Such comparatively high ground as exists has a much gentler slope; and the impression of flatness given by the Eastern Counties arises from the general absence of distinct hills, not from the presence of an unusual expanse of ground but slightly above the level of the sea. Except in parts of Southern Essex, the Chalk and the overlying Tertiary formations are almost everywhere covered by the Boulder Clay and by other superficial beds, and most of the present surface consists of a plateau which occasionally rises to a height of more than 300 feet above the sea, but is usually below that level, the Chalk and the Tertiary beds appearing chiefly in the valleys of the various streams intersecting the flat-topped, drift-capped plateau. Such being the nature of the country, it is evident that in order to make a thoroughly eligible site therein for an ancient defensive work, it was usually necessary to elevate it artificially, so as to secure some advantage in height over the highest adjacent ground. Of course, a Norman architect would feel no need for an artificial mound for the site of his keep, inasmuch as that structure itself would give the required elevation. And he would naturally prefer a site for that massive building as solid and firm as possible, and would recognise that to place it on a newly-raised mound of loose material would be the height of folly. But it does not follow that he would necessarily reject a mound that had been consolidated by time, and which, indeed, he might not recognise as being artificial at all. Hence, I think that we are entitled to assume that wherever we find a Norman Keep on an artificial mound, as at Norwich and Hedingham, the mound existed one or more centuries before the Keep.

The question then arises:—In what way, apart from sections cut across its ramparts and ditches, can we form any opinion as to the probable date of an ancient defensive earthwork? In other words, on what grounds may we conclude, that it is probably British rather than Saxon, or Saxon rather than British?

In many instances the answer must be a very doubtful one, but as examples I will discuss some of those of the Eastern Counties.

The position of Norwich, at the head of what was before the 11th century, an estuary, and just above and between the confluence of the rivers Yare and Wensum, is one that must have been occupied by some kind of town from the earliest period. But it is equally obvious that the town must always have needed earthworks for its protection, as the two streams enclose ground in which there are no river cliffs, while they would themselves furnish but a slight defence against a land attack, and form a highway for an enemy on the water. And I can see no reason why the partly artificial mound on which the Norman Keep now stands should not be as ancient as the rest of the defensive works. For it appears to me that the great development of artificial mounds for defensive purposes in the Eastern Counties is simply the result of the extremely flattened contours there, and has no necessary connection with the habits of any particular race. Any people, Stone-age or Saxon, whose forts were palisaded earthworks, would be equally likely to construct huge mounds. When we call to mind, for instance, that the round barrows of Salisbury Plain, and the gigantic mound of Silbury, on Marlborough Downs, were heaped together by extremely primitive people from the surrounding chalk, there can be no reason to doubt the capability of such people to form similar mounds, for defensive purposes, out of the usually softer strata of East Anglia, nor any reason for supposing that the idea would not be likely to occur to them, should circumstances make mounds peculiarly advantageous.

I think there can be little doubt that there was a British town on the site of Norwich before the building of the Roman station at Caister, three miles southward. It is true that a popular rhyme exists, which says:—

"Caister was a city when Norwich was none,
And Norwich was built of Caister stone."

But the Norwich of, and previous to, the Roman occupation was doubtless built of wood and other perishable materials, and the Norwich for which the stone of Caister was used was necessarily the city of a period later than the Roman occupation. And, on the other hand, it is difficult to account for the presence of the Roman town on the Taus if the site of Norwich remained unoccupied at the time, the latter being evidently the better from the Roman point of view. Indeed the distribution of Roman stations, as a general rule, was mainly influenced by that of towns already existing.

At Thetford, on the Norfolk and Suffolk border, there is an immense artificial mound, the centre of massive defensive earthworks. Thetford appears to have been a place of much importance in Saxon times. A glance at a geological map of the district shows that it occupies, as regards the rivers flowing into the Wash from West Norfolk, a position somewhat similar to that of Norwich among the streams of East Norfolk. The Little Ouse, on which Thetford stands, is the river by which the Danes most easily penetrated into East Anglia from the Wash. Consequently it is not surprising that both Norwich and Thetford were much besieged by them. But the importance of Thetford must have been just as great in the times of still earlier piratical invaders. And in this case we find a popular tradition that the Thetford Mound is the result of the Devil having wiped his shoes at that spot after having dug the dyke bearing his name at Newmarket—a tradition showing that to the people now inhabiting the district it is prehistoric.[1] This gives a very strong presumption that the Thetford Mound and other earthworks are British, not Saxon. Some antiquaries suppose Thetford to be the site of the Roman Sitomagus, while others place it elsewhere.

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[1] *Gentleman's Mag. Library. Archæology, Part* 2, pp. 329-30.

Another place in Norfolk at which a huge mound with massive outer earthworks exists is Castle Acre. There is, however, more direct evidence as to antiquity in this case. For Mr. Harrod discovered much Roman pottery when excavating on the great mound, and Roman coins have been found in the outer enclosure.[2] And he thinks the enclosure south of the mound and near the Church to be a Roman camp, somewhat irregular in form from having been connected with earlier British entrenchments. Castle Acre, too, stands on the line of a very ancient road known as the Peddar's Way, which crosses Norfolk from a point near Brancaster to another three or four miles east of Thetford. In short, the available evidence in this case favours the view that at Castle Acre we have the remains of British and Roman earthworks, and there is nothing tending to an opposite conclusion.

I now come to the Suffolk and Essex border. On the Suffolk side of the Stour is the little town of Clare, in the angle between that stream and a little brook which flows into it from the north. Here again is a huge mound connected with massive defensive outer earthworks, modern encroachments, as at Castle Acre, obscuring the original plan. A few hundred yards north of the great mound is a square camp, apparently Roman, and probably owing its position there to the previous existence of the British stronghold close by, on a decidedly more eligible site—as at Norwich. In this case the Roman camp is neither so closely connected with the British earthworks as at Castle Acre, nor so far removed as at Norwich.

The earthworks of Thetford, Castle Acre and Clare all rise from low ground. So do those of Great Canfield, about four miles south-west of Dunmow, in Essex, where there is a large moated mound connected with a massive horse-shoe shaped outer entrenchment. There does not seem to be any evidence bearing upon the antiquity of these Great Canfield earthworks. The village has a Norman church, and is near an ancient line of road, but there is nothing, so far as I am aware, tending to show that the stronghold is British rather than Saxon, or the reverse.

In the grand earthworks of Pleshey we have, on the other hand, an evident choice of what is, for Essex, a naturally strong position. Here there is a magnificent moated mound with a horse-shoe shaped work southward, and extensive outer entrenchments on the edge of a tract of high ground. In Murray's *Handbook to the Eastern Counties* we are informed that "the castle was founded within the lines of a Roman entrenchment, near which urns and other antiquities have been found." At the present day Pleshey seems to be a singularly out-of-the-way place. But a glance at Norden's Map of Essex shows it very near the old line of road from the neighbourhood of Chelmsford to, and beyond Great Chesterford, and not far from the Roman road from Writtle (Cæsaromagus) to and beyond Braintree. Here, again, the available evidence seems to point to a British origin for these earthworks.

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[2] See Murray's *Handbook to the Eastern Counties*, p. 283.

On the border of Hertfordshire and Essex stand the defensive earthworks of Stansted Mountfitchet. They consist of a mound surrounded by a rampart and ditch, connected by a narrow neck of ground with a much larger enclosure of a horseshoe shape, and with other outworks. There are some signs of masonry at the base of the rampart surrounding the keep mound, but that surrounding the larger enclosure seems to consist wholly of gravel belonging to the Glacial Drift, which, with the Chalk on which it rests, make up the Castle hill. East of this outer rampart is a large pit showing about 25ft. of gravel above Chalk, this pit extending as far westward as the foot of the rampart. The situation of this Castle is one of unusual natural strength for Essex. South and west of it there is a natural valley, which extends also to some extent northward, so as to give some advantage on every side except the eastern, where the castle promontory joins the drift-covered plateau of which the country consists except where river valleys intervene. On the east, accordingly, the rampart is higher and the ditch deeper than elsewhere. The keep mound is slightly lower than the main outwork. As it is on the western, or naturally strong side of the Castle, there is no need for anything like the accumulation of earth to be seen at Pleshey or Rayleigh. As regards the antiquity of these earthworks, it appears to me that the natural strength of the site, together with the fact that the word *Stanstead* implies a site on a Roman road, gives a presumption in favour of British rather than Saxon age.

We now come to Rayleigh. In south Essex, at Laindon (or Langdon) hill, and about Rayleigh, we have two small tracts of land unusually high for that part of the county. Geologically they consist of outlying patches of Bagshot Beds lying above London Clay, while here and there some high-level gravel rests on the Bagshot Beds, which are mainly sandy. The larger of these two tracts is that on which Hadleigh, Rayleigh and part of Hockley stand. At Hadleigh are the remains of a 13th century castle, and at Rayleigh are massive defensive earthworks which have never been crowned with masonry, though Rayleigh is the only Essex Castle mentioned in Domesday Book. As the earthworks at Pleshey and Great Canfield must have existed at that time, it is evident that to the compilers of Domesday the castle meant the buildings on the earthworks and not the earthworks themselves, even though the buildings were but of wood, not of brick or stone. As to plan, there is at Rayleigh a high circular mound connected by a narrow neck with a much larger and lower horse-shoe shaped entrenchment, a deep ditch surrounding both. In addition there are some remains of outer works. This general similarity of plan between Great Canfield, Pleshey and Rayleigh makes the omission of all but the last named the more significant. As it is stated in Domesday that "in hoc manerio fecit Suenus suum castellum," it has usually been held (forgetful of this omission) that Suene made the earthworks as well as the buildings which once rested upon them. Suene was a great land owner, holding, Morant tells us, 55 Lordships in Essex, and all that he probably did was to rebuild or restore the wooden structures and palisades of Rayleigh Castle when he made it his chief residence.

And we may infer that at the time of the Domesday Survey the buildings on the mounds of Great Canfield and Pleshey had been neglected and allowed to decay and perhaps disappear. At least they were unhabitable. This seems to me to give in itself a presumption against the view that the earthworks of Great Canfield and Pleshey were made or greatly modified by the Saxons. For supposing the buildings on them to have been burnt or destroyed by the Danes, yet, as Essex seems to have been free from Danish incursions during the period of 70 years between the battle of Assandun and the compilation of Domesday book, it is hardly probable that, if they had been the residences of Saxon landowners, they would not have been made habitable before the last-named event. If wooden buildings are more easily destroyed than structures of brick or stone, they are also much more easily and cheaply rebuilt.

The site of Rayleigh Castle on the small tract of high ground between the Thames and the Crouch, is one that must always have seemed the best in that district as the place for a camp of refuge. The surface of the ground occupied by the town of Rayleigh is almost all of it more than 200ft. above the sea, the greatest elevation I have seen noted on the map being 276ft. This gives a healthy elevation in a district bounded by the once ague-haunted marshes of Canvey Island on the south, and by those of the Crouch and its tributary the Roach on the north and east. And it must always have had a decided advantage over the London Clay area around as regards water supply, that obtainable here and there from the uppermost beds of the London Clay being usually unpleasant, while the rest of that formation yields none whatever. In ancient times this district was peculiarly accessible to piratical marauders, who might come up the Roach, the Crouch, or the Thames. The town of Rayleigh stands about midway between Benfleet on the south, where Alfred destroyed the Danish fleet, and the highest point on the Crouch, northward, to which sea-rovers were likely to bring their ships. The Castle is on a promontory of the high ground which juts out westward from the main mass, so as to afford a better natural site for a stronghold than could be expected in Essex. If somewhat inferior to a hill fort on the Chalk south of the Thames in needing some artificial increase to the height of the chief mound, it had an advantage over almost all of them as regards water supply. For whereas Chalk camps are usually dependent on the storage of rain water in "dewponds," at Rayleigh water oozes out at the junction of the London Clay with the overlying Bagshot Sands east of the Castle mounds, and supplies the large pond within the outer works, which I am informed is never dry in the driest season.

Mr. G. T. Clark, writing on "Moated Mounds or Burhs" in the *Archæological Journal*[3] remarks that "these Burhs are not like British earthworks placed on the tops of hills, nor like Roman stations upon main roads; they were the centres of large Saxon estates, the seats of great landowners." (*Archæological Journal*, Vol. 46, p. 197, 1889). And in a previous paper (Vol. 38, pp. 26-7), he says that they were thrown up in the ninth and tenth centuries for the defence of private estates, and that they are not governed to any great extent by the character of the ground. As Essex examples of Burhs, he gives, in the latest of the papers mentioned, "Blethebury," (?)[4] Mount

[3] Vols. 24, 38 and 46.

[4] This is the name given in Clark's paper, "List of Burhs," *Archæol. Journ.*, vol. 46, p. 203. But I must confess that I cannot find out where it is, though Clark adds—"A seat of the Anglo-Saxon Kings. Banks and ditches. Qy. Mound."

Bures, Milton, Maldon, Pleshey, Shoebury, Chipping Ongar and West Ham. Among the Hertfordshire examples are Stanstead Mountfitchet and Bishop Stortford.

A singular feature about this list, which is given in the latest of the papers mentioned (*Arch. Journ.*, Vol. 46. 1889), that styled "A Contribution to a complete list of Moated Mounds or Burhs," is that after mentioning Blethebury, Milton, Maldon, Shoebury and West Ham. Mr. Clark adds, "Query, gone," or "Query, mound," there being apparently no evidence that a mound ever existed at the places named. On the other hand the mounds at Stebbing,[5] Great Canfield and Rayleigh are not mentioned at all. However, though I think that the earthworks of Pleshey belong to the same class as those of Rayleigh, I would not include either as mere Burhs. Passing over the moundless Burhs mentioned by Mr. Clark, it appears to me that the defensive earthworks of Essex and its borders having mounds are divisible into two classes as distinct as are the Border Castles, such as Alnwick, Warkworth or Bamborough, from mere Border peel towers. In the more important class I would group Clare, Stansted Mountfitchet, Pleshey and Rayleigh; in the less important, Bishop Stortford, Chipping Ongar, Mount Bures and Stebbing. The latter may well have been the mere fortified centres of Saxon estates, but, as we have seen, the available evidence tends to show that the former are of earlier date and occupied positions of much greater importance.

It may probably be urged, on the other side, that though much of the earthworks at Norwich, Castle Acre, Thetford and other places may have been British, yet that the great mound is a distinctive Saxon feature, and must have been added at a later date. I have already reminded you that even to the prehistoric people who made the gigantic mound at Silbury and the smaller barrows of Salisbury Plain, mound-making was an extremely familiar operation. Also that if the great mound in defensive earthworks is a peculiarly Saxon feature, it is an extraordinary thing that there should exist a popular tradition that the huge mound at Thetford—a town so prominent in the ninth and tenth centuries—was the work of the Devil. For I need hardly point out that such an explanation, wherever it may be met with, implies that the object to which this origin is imputed is not the work of the race thus explaining its existence—which in this case is the Saxon.

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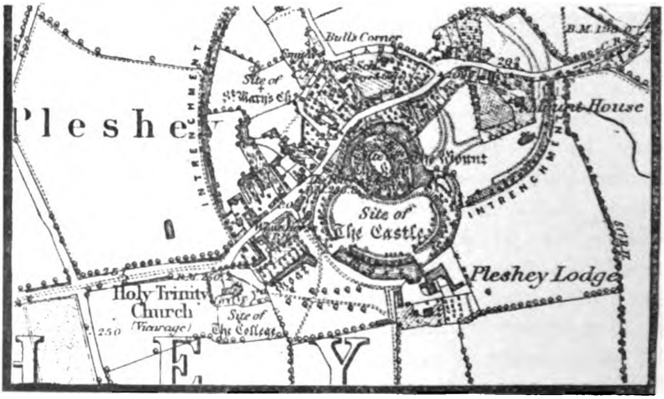
[5] The Stebbing mound is not mentioned either by Morant or in Murray's *Handbook to Eastern Counties*. It is simply a moated mound.

Though Chalk camps south of the Thames have no urgent need of artificial mounds, their positions being so strong naturally that they would derive but little advantage from structures necessary in the Eastern Counties, yet I have seen an ancient British camp on the Chalk of Kent, the plan of which allies it not to the ordinary entrenchments on the Chalk of the southern counties, but to the strongholds of Rayleigh, Pleshey and Stanstead Mountfitchet. It is that, already mentioned, which stands on the Chalk escarpment north of Folkestone and is popularly known as "Cæsar's Camp."

This occupies a very strong natural position on a portion of the Chalk escarpment which is almost isolated from the main mass, but it differs in plan from every other Chalk entrenchment I have seen. Instead of being surrounded, as usual, by a simple rampart and ditch, there is, as at Rayleigh, Pleshey, Stanstead Mountfitchet and other places, a smaller enclosure, resembling the Keep-mound of those places, surrounded by a rampart and ditch, and connected by means of a narrow neck of ground with a much larger horse-shoe shaped entrenchment, also surrounded with a rampart and ditch. The name Cæsar's Camp has evidently been given to it in consequence of the finding of Roman tiles and pottery within its entrenchments;[6] but, as I have already stated, its position and shape are those of a British not of a Roman Camp, though the Romans doubtless made occasional use of it, as it is about midway between their stations at Dover



PLAN OF THE PLESHEY EARTHWORKS. FROM THE ORDNANCE MAP. (Six inches=one mile).

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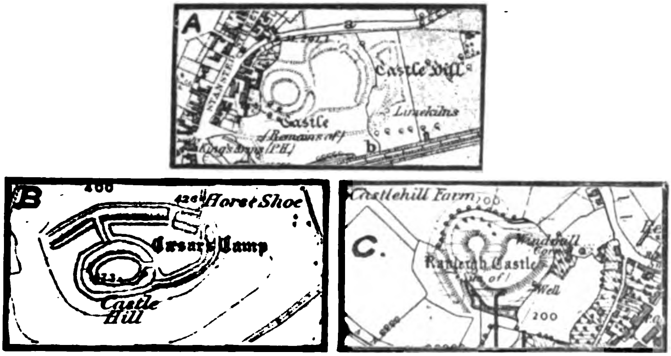
[6] Murray's *Handbook for Kent*, p. 43.

and Lymne. Of course, any practice adopted by the Britons of East Kent would be more likely to be diffused among the tribes living north of the Thames, but near the coast and the rivers, than among those more removed from the great watery highway. So I think that, so far as this piece of evidence goes, it also points towards the conclusion that in the earthworks of Pleshey, Stanstead Mountfitchet and Rayleigh we have British forts of the advanced type shown in Cæsar's Camp at Folkestone.[7] But the resemblances between them are best shown by means of the ordnance map, that most impartial of authorities.

In addition, I add a plan from the ordnance map, on the same scale, of Old Sarum, the well-known British oppidum which had a continuous existence as a town throughout the Roman Occupation and down to the end of the thirteenth century. Of course, under the above circumstances, it is impossible to say to what period the inner mound or citadel belongs. But it is evident that any resemblance between it and Rayleigh is extremely slight compared with that between Rayleigh and the presumably unmodified British camp at Folkestone.



PLANS OF ANCIENT EARTHWORKS. FROM THE ORDNANCE SURVEY MAPS. (Six inches=one mile).

A. Stansted Mountfitchet "Castle," Essex. (*East of the hedge between "a" and "b" is the gravel pit, which now extends as far as the "H" in Castle Hill.*)

B. Cæsar's Camp, Folkestone, Kent.

C. Rayleigh "Castle," Essex.

The question may now present itself: Why was a site favoured by nature and improved by primitive art as that of

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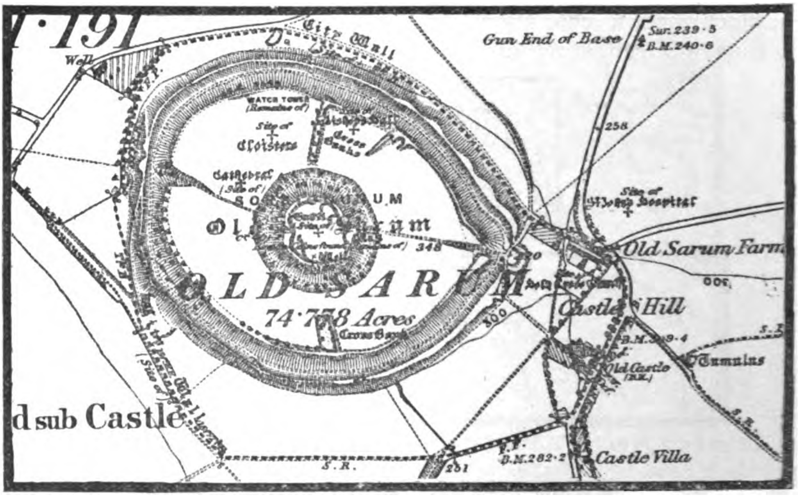
[7] On telling Mr. W. Cole that I had been writing the above remarks, he directed my attention to a paper by Mr. H. Laver, on Rayleigh Mount (*Trans Essex Arch. Soc.*, Vol. iv., Part III. (1892). I find, however, on reading Mr. Laver's paper that he has arrived at similar conclusions by a different route.—T. V. H.

Rayleigh Castle soon abandoned after the Norman Conquest? Two influences both tended to produce this result. In the first place, though Rayleigh was the best place in the district as a camp of refuge, it became a less convenient place for a Castle than Hadleigh, overlooking the Thames, under a stronger and more settled government than that of the Saxon and Danish Kings; just as to the Romans, Lymne was a better spot for a station than "Cæsar's Camp," Folkestone. Secondly, comes an event in family history. Henry de Essex, the grandson of Suene (who held the manor before and after the Conquest), was hereditary standard bearer to King Henry II. But during a battle with the Welsh, in Flintshire, in that King's reign, he threw down his standard and ran away, his conduct tending largely to the utter rout of the English army which followed. He lived to fight another day, for Morant says:—"For which high misdemeanour being charged with treason by Robert de Montford, and in a solemn tryal by battle clearly vanquished, he ought to have suffered death by the law, but the King spared his life and caused him to be shorn a Monk in the Abbey of Reading, the combat having been performed in that town."



Plan of Old Sarum. From the Ordnance Map. (Six inches=one mile).

The manor of Rayleigh was then annexed to the Crown for centuries. And thus Suene's wooden buildings were never replaced by Norman masonry.

FRESH-WATER ALGÆ:
A SKETCH OF THEIR STRUCTURE, DISTRIBUTION AND RELATIONSHIPS.

By E. D. MARQUAND, *Kew Museum.*

[*Being an Address delivered at the Meeting in Epping Forest, on April 10th, 1897.*]

[After some introductory observations Mr. Marquand continued:—]

THE Algæ comprise the lowest forms of vegetable life, the very earliest rudiments as it were of the great world of plants. Here we find the very simplest of all possible conditions of existence, the single separate cell, leading a perfectly independent existence.

The most unobservant person cannot fail to have noticed how in shady places walls, wooden fences, and tree-trunks are coated with a vivid-green powdery layer which comes off on one's clothes at the slightest touch. This is *Pleurococcus*, one of the very lowest of unicellular Algæ, and probably in temperate climates the most abundant of all plants. You will find this powdery coating consists of an immense multitude of small round cells, uniformly green in colour, and often adhering together in little clusters of from 2 to 8. Multiplication takes place by simple division; each cell divides in the middle and each half becomes a perfect cell. This process of cell-division is the most simple of all conceivable modes of increase, and in *Pleurococcus* it takes place with amazing rapidity. An American botanist records that under his own observation one single cell produced in the course of 10 days a colony of more than 600,000 cells. This accounts for the sudden appearance of a green coating on palings and damp woodwork during warm moist weather.

Porphyridium, the alga which forms the blood stains on damp ground, that I spoke of in my introductory observations, multiplies in the same way, but not quite so rapidly, and partly for that reason is not quite so common.

The belief is now commonly entertained, though at present the theory is not supported by direct proof, that these very simple unicellular algæ (of which there are a large number of forms) are not perfect plants at all, but are merely growth stages or arrested conditions of development of higher forms; these simple cells divide and re-divide and so serve to form a stratum or bed upon which in course of time, and under the requisite favorable conditions of temperature and moisture, the original filamentous type of the parent plant may be reproduced. This is what is called the "polymorphism theory" and like many other things, it has come over to us from Germany. There is, however, a good deal of evidence in support of it, and the theory gains ground. In the days of the old naturalists, and indeed within the memory of many persons still living, motion was regarded as the distinctive attribute of animal life—an organism capable of spontaneous movement was by that very fact an animal, whilst one which remained throughout its existence incapable of free motion, was a plant. It is now well known, however, that spontaneous movement is a power common to all protoplasm, whether it belongs to a plant or to an animal. And so it happens that there is no longer a vain endeavour made to discover the separating line between the two great kingdoms. Why it should have been supposed in later times that a hard and fast line exists, is difficult to comprehend, because the more we learn the clearer we perceive that Nature despises a *dividing line* as much as she does a *straight line.* Groups everywhere, large and small, merge into each other by insensible gradations, boldly defying anything like rigid mathematical precision.

Locomotion is very general among the lower algæ at some stage or other of their existence, but some of them are motile throughout their whole career. Perhaps the most beautiful example of a purely free-swimming alga is *Volvox.* Surely nothing can surpass this, for exquisite grace and beauty. Conceive a tiny spherical globe, mathematically perfect in form, as light and delicate and translucent as a soap-bubble, dotted all over with brilliant emerald beads set at regular distances apart. Let there be three or four smaller, but exactly similar pale green globes enclosed within the larger one; then imagine this tinted glassy sphere rolling and revolving on its axis, and gently sailing through the water in all sorts of graceful curves—and you have *Volvox.*

There are two very extensive groups which have received a great deal of attention from persons who have not otherwise studied the algæ; indeed they are at once so surpassingly interesting and so infinite in variety and numbers that they are commonly treated of by themselves; I refer to the Desmids and the Diatoms, well-known to everyone who has intelligently used the microscope. They are all exceedingly minute, the giants among them being hardly distinguishable by the naked eye, and although possessing a certain superficial resemblance the two groups are easily separated by constant and well-marked characters.

In Diatoms the outer envelope or shell is composed entirely of pure flint, so that they will resist the action of fire or strong acids. These flinty shells are beautifully striated and sculptured, and sometimes marked with lines of such extreme fineness that they are used as tests for the highest powers of the microscope. In Desmids on the contrary the outer case is never siliceous, and seldom bears markings of any kind. Again, in Diatoms the colouring-matter of the cells is a rich golden brown, whilst in Desmids it is a bright grass green, so that in the living plants the colour alone is sufficient to distinguish them.

As regards habitat, Diatoms are probably the most widely distributed of all organized beings, for they occur in a living state wherever there is standing water—fresh, salt, or brackish, from the Equator to the Poles; and large tracts of country are composed entirely of their fossil remains. Desmids on the other hand are much more restricted in the range, being confined exclusively to freshwater; and very few traces of them have been found in geological deposits.

Any person observing for the first time the peculiar spontaneous motions of the free Diatoms might well be excused for assigning them a place in the animal kingdom, as the old naturalists did. Some species are incessantly moving, steering their way with great precision and rapidity among the objects surrounding them. For some time they may hold a straight course, but not infrequently they deviate sideways without apparent cause, and after deviating, return regain. They double round projecting objects or push them out of the way in a surprising manner, and in short, behave exactly like animals. And yet no one has been able to discover how this movement is produced. Endless theories have been propounded, but nothing has been satisfactorily proved, and the movements of the Diatoms must still be numbered among the unsolved problems which nature presents to the student.

Desmids also possess the faculty of locomotion, but in a much more feeble degree Compared with Diatoms the most active Desmids are slow and sluggish, and in the majority, the movement is scarcely if at all perceptible. The motion is usually slow and creeping, and some forms (such as *Closterium* and *Penium*) have a curious rotating movement, one end remaining fixed while the other oscillates.

Time will not allow me even to mention a host of interesting and beautiful microscopic plants of unicellular structure which abound in stagnant pools and moorland ditches. Indeed the subject of the Freshwater Algæ is so extensive that many evenings could very profitably be devoted to them, taking one or two sections at a time. All I can do to-night is to skip from one group to another in an erratic and superficial way, taking examples almost at random, without any definite scientific arrangement.

Before leaving the unicellular algæ there is just one point to be noted. What we commonly regard as a plant does not always consist of one detached cell only; in certain groups a number of single cells are united in a common investment or joined together by protoplasmic processes into a family or colony, which is technically termed a *cœnobium*; and this colony in most cases assumes a symmetrical form. The number of individuals composing such a colony varies greatly, *Pediastrum* consists of about a dozen polygonal cells which form a flat plate-like disc, the cells of the outer row or rim being drawn out into lobes or teeth. This is a *small* colony compared with Volvox, which though only about one millimetre in diameter, is composed of from 10,000 to 20,000 individual cells. In the alga called the "Water-net" or *Hydrodictyon*, the number of cells is indefinite they are joined end to end and form the sides of the honeycomb network.

A large tribe of Algæ, composing the class Cyanophyceæ are characterized by the absence of chlorophyll, or pure green colouring matter, the prevailing hue of the cell-contents being steel blue or blue green in various shades of intensity. As you all probably know the classification of the seaweeds into their principal divisions, mainly follows the colour of the plants. Thus we have the Green Algæ, the Brown Algæ, the Red or Pink Algæ, and the Blue-green Algæ. Colour, however, is in itself of no systematic importance—many systematists ignore it almost entirely--but it so happens that differences in colour generally (though not invariably) coincide with important morphological distinctions.

In the Blue-green Algæ we find the cells filled with pale bluish protoplasm, never pure grass-green as in the Desmids. Some are terrestrial and some aquatic, and generally when out of the water they become invested in a gelatinous envelope, and may then resemble a mass of jelly. A familiar example of this class is the bladdery india-rubber-like *Nostoc* which makes its appearance on shady gravel paths in gardens. If a small portion of the plant be placed in water and examined under the microscope it will be found to consist of a dense mass of interwoven necklace-like filaments, embedded in colourless jelly.

Although abundant everywhere and in great variety, very little is known about the life histories of the Blue-green Algæ, and in none of them has any kind of sexual reproduction been observed. Sometimes they appear suddenly in enormous quantities in some place, and then just as mysteriously and suddenly disappear, and are seen no more. They are classed among the Algæ from their habit and mode of life, but some genera have much in common with the bacteria and other simple fungi. Many authorities consider that they are not autonomous forms at all, but merely intermediate life-conditions or arrested growths of higher plants.

The large genus *Oscillatoria* is one of the most curious and interesting in the entire family, on account of the remarkable animal-like movement of the filaments. In this respect *Oscillatoria* appears at first sight even more wonderful than the free Diatoms, because it is so much more plant-like in character and appearance. The movements of the filaments are of three kinds: Firstly, there is a pendulum-like swinging of the filament from side to side, one end remaining quiescent; secondly, there is a peculiar flexure of the filament itself, which can only be compared to the twisting of a worm; and thirdly, there is the simple onward movement of progression. Some species move much more rapidly than others; in some, a very small fragment of the plant, taken up on a needle point—a little bundle of filaments in fact—will in a few hours spread over a comparatively large surface of water. How these movements are caused no one knows, though probably the attraction of light has something to do with it.

In the section called the Siphoneæ we find a curious group of plants distinguished by non-cellular structure. Although consisting of branched filaments several inches in length, the protoplasm is not partitioned off by walls into distinct cells, as in other plants, but is perfectly continuous throughout both stem and branches. The whole plant in fact consists of a long slender sac filled with chlorophyll. Some of them—especially species of the genus *Vaucheria*—occur abundantly on the margins of ponds and ditches, and on damp earth, where they form a dense layer of green velvet; one or two species are common on the surface of the soil in fern-pots, where they form a tangled matting often troublesome to get rid of. Curiously enough though one of the simplest of its order in *vegetative* structure, *Vaucheria* is more highly differentiated as regards its reproductive system than any member of the family at present known.

The reproduction of the Algæ presents a greater variety of phenomena than is to be found in perhaps any other of the large divisions of plants. It would not be possible to go fully into the matter within the limits of one short paper; moreover the subject fairly bristles with technicalities, enveloped in uncouth Greek and Latin compounds by no means familiar to Lord Macaulay's proverbial schoolboy Now, roughly speaking, all the varied phenomena of reproduction may be classed under two heads: the asexual and the sexual. In the former case the species is reproduced without the intervention of fecundation, by the development of zoöspores, which are active, and as their name implies, animal-like in their character.

Taking as a type a very common alga in pools—*Œdogonium*, with long green unbranched filaments, and well-marked cells—we find the entire contents of a cell are used up to form a zoöspore, which when mature is pear-shaped, and at the smaller extremity fringed with cilia, by the rapid vibration of which the zoöspore is able to move through the water with great activity, exactly like an animalcule. After swimming about freely for some time- an hour or two perhaps, it comes to rest, and attaches itself to a solid body, and then immediately starts growing into a new filament like the parent.

This mode of reproduction by motile spores capable of immediate germination is extremely common among the algæ, and is especially characteristic of the Chlorophyceæ, or pure green group. It may be taken as a type of *asexual* reproduction, but it is needless to say that many modifications occur. The important point to note is that in its very earliest stage the plant is endowed with the power of locomotion, and that in a very marked degree.

The modes of *sexual* reproduction are extremely varied, and much less easy to describe briefly, We may take as the type of one mode, the process which occurs in *Spirogyra*. These plants are familiar objects to every one who has made any study of pond life, for the species are very numerous and abundantly distributed. And, moreover, every kind of *Spirogyra* is at once distinguished by the beautiful arrangement of the chlorophyll, which takes the form of narrow spiral bands winding through the whole length of the filament. Another distinguishing character is that the filaments are always free, and never attached at one end to some solid object, as in the case in *Œdogonium*.

In *Spirogyra* reproduction takes place between two filaments lying side by side, the cells of which send out lateral outgrowths which unite and coalesce, and then the protoplasm passes from one cell, through the connecting band, into the opposite cell, and there forms a spore; and in this way the spore is the result of the fusion of the protoplasm of both cells. This process is termed conjugation, from the conjugating or yoking together of the cells, and in like manner the resulting spore is called a zygospore. This method of spore-formation is prevalent among the Desmids, which with *Spirogyra* and a few other genera, constitute the family Conjugatæ.

In *Vaucheria*, on the other hand, quite a different sort of operation takes place. A small branchlet sprouts out upon a filament and develops a multitude of excessively minute flask-shaped bodies, each furnished at one end with a pair of cilia; these are called spermatozoids, and they swim about freely in the water. In the meantime on another part of the plant there develops a somewhat globular outgrowth having a minute aperture at the apex. Into this aperture some of the roving spermatozoïds find their way, and fertilization takes place; after which the fertilized cell is called an oöspore. This process is precisely similar to that which prevails in the higher plants, The fertilized cell now becomes a resting-spore, and is able to endure a period of drought with safety.

It would be easy to give examples of other modes of sexual reproduction, but these two types must suffice. One point it will be well to bear in mind, as it fixes an important physiological distinction. In the first example, *Spirogyra*, we have an instance of *conjugation*, or the union of two *similar* cells, and the result is the production of a *zygospore*. In the second example, *Vancheria*, we have an instance of *fertilization*, or the union of *unlike* cells, and the result is the production of an *oöspore*.

If we leave aside for the moment the section of the Blue-green Algæ or Cyanophyceæ—a group of rather obscure plants, of which the real relationships are open to doubt, it may be said that practically the whole bulk of fresh-water species are Green Algæ, and there can hardly be a more fascinating group of plants than this, whether to the strictly scientific botanist or to the simple lover of nature. Because firstly, they are the most widely diffused as well as the simplest of all plant forms; secondly, they are of surpassing variety and beauty, quite unlike any other members of the vegetable world; and then, thirdly, they claim our special interest by the fact that we must look among them not only for indications of the orgin of all plant life, and of the forms from which the whole of the higher plant world arose, but also for aids and hints towards the solution of some of the most difficult fundamental problems with which biologists are occupied; such as the real nature and origin of sexual reproduction, the functions of the nucleus and its relation to the protoplasm, and many other questions of that kind.

In their lower forms the Green Algæ are very closely allied to those organisms — undoubted animals — which zoölogists term the Flagellate Protozoa. In fact there exists an unbroken series of forms connecting unquestionable Protozoa, having mouths by which they eat solid food, with unquestionable Green Algæ depending entirely upon soluble inorganic food. It is, therefore, quite clear that the dividing line between animals and plants is entirely an artificial one, and is very naturally drawn by different authorities at different points in the series. And then on the other side the Algæ are very intimately related to the Fungi and the Lichens, and here again the boundary is obscure and ever-changing, various genera being shifted and shunted about from time to time in the most perplexing fashion, until at last it seems a hopeless task to endeavour to determine the limits of either of the great sub-kingdoms.

The Classification of the Algæ is in the main based upon the character and modes of reproduction, just as it is in other plants. According to one of the latest theories all the various forms of vegetable life are to be traced to three lines of descent, represented by three distinct kinds of cell-contents: the colourless, the pale blue, and the pure green.

The first series originates in the Bacteria, and through them are derived the whole tribe of Fungi. The second primordial type consists of organisms in which the cell contents are of a pale blue, or watery, bluish-green colour, entirely devoid of true chlorophyll, starch-grains and nucleus. These comprise the Phycochromophyceæ, *i.e.*, the Blue-green Algæ of which I have given as examples *Nostoc* and *Oscillatoria*. This group has never developed into a high stage, but by what the Germans call "retrogressive development," a sort of evolution in a backward direction, in other words, by a partial or complete suppression of either the reproductive or the vegetative organs, they have been incapable of advance. The third and most important series of all, the Chlorophyllophyceæ, that is to say the pure grass-green Algæ, are the only stock which has developed into the higher plants. This division is characterized from the outset by the cells possessing a nucleus, starch grains, pure chlorophyll, and in certain states a true cell-wall of cellulose.

It would be dry and unprofitable work to go further into the classification of the Algæ, and to those who have not studied the subject a little, it would be difficult to make it intelligible.

The Freshwater Algæ are hardly likely ever to become a popular study in the same sense in which ferns and seaweeds are. With very few exceptions they present when dried but small attractions in the way of elegance and beauty. You cannot make a pretty album for the drawing-room table out of them. But if you once start studying them in a living state under the microscope you will enter upon an absolutely inexhaustible field of beauty, the very existence of which you had never suspected.

I should like to urge upon all who take up the study of these humble plants, the desirability and value of making carefully-executed pen and ink sketches of every species they meet with, or better still, water-colour drawings, imitating as closely as possible the exact tint of the object under examination. These drawings should be accompanied by a written description, as minute and full as possible, together with particulars of habitat and the date. Sketches and descriptions of this kind take up very little time, and they answer a two-fold purpose. Firstly, they impress the object much more clearly upon the memory and direct attention to many minute points which would readily escape the eye during a mere cursory examination; and secondly, they will prove at a future period absolutely invaluable for the purpose of study and comparison. The difficulty—even in most cases the impossibility of preserving the Freshwater Algæ so as to retain their graceful outlines and delicate tints, renders this course the only alternative; but the marvellous beauty of their forms and the variety of their colours will amply reward any time and labour spent in their delineation.

One word in conclusion as to books treating on the subject. The first English work was Hassall's *British Freshwater Algæ*, in two volumes, published half a century ago. It is now very scarce, and second-hand copies fetch a high price, and though a book of much value when first it appeared, it has long been superseded.

The best complete work on the subject as far as the whole of Europe is concerned is Rabenhorst's *Flora Europæa Algarum*, published 30 years ago. It is written in Latin, and gives a rough figure of every genus, Decidedly the best work on the British species is Cooke's *British Freshwater Algæ* in two volumes, giving a coloured figure of every form. This work has, however, been out of print for some time, and second-hand copies are expensive when they are to be had at all.

But for quite a beginner in the study there is no better book than Cooke's little *Introduction to the Freshwater Algæ* recently published. It is one of the International Scientific Series, so that it has the merit of being within the reach of everyone. Most, if not all, the British species are described and every genus figured. When the young student has mastered the details of this little book, he will be better able to make use of the many splendid monographs of the continental Algologists, which are quite indispensable in the advanced study of the Freshwater Algæ.[1]

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[1] The recorded species of the Fresh-water Algæ of Essex (excluding the Diatomaceæ) have been listed by Dr. Cooke in the *Essex Nat.*, vol. vii., p.p. 170-79. Species from the Kelvedon district were recorded by the late E. G. Varenne in *E.N.*, vol. v., pp. 25-30; and several Forest localities are given in Dr. Cooke's interesting chapter on "Pond Life in the Forest," in the new edition (the 4th, 1897) of Mr. Buxton's *Epping Forest*.—Ed.

GENERAL REMARKS ON THE MARINE NATURAL HISTORY OF THE COLNE ESTUARY.

By H. B. SORBY, LL.D., F.R.S., F.L.S., &c.

[*Read at the Meeting on the Colne, September 9th,* 1879.]

MY studies of the marine animals and plants in the Colne district have been almost entirely confined to those parts not included in the Oyster Fishery, and to the summer months. In the Colne itself and the adjoining creeks I have collected such animals as float near the surface, or can be obtained on the shore at low water; and outside the limits of the fishery I have often dredged and used a small trawl, though very rarely at any considerable distance from the shore. I have never attempted to examine the whole district, or to make a complete list of what I have found; and now that I am living on the yacht I have but few books and specimens to enable me to identify some of the animals and plants which I have collected at various times. My impression is that during the last ten years there has been a decided change; since, when I first began to dredge, I found several interesting things which I have not seen for several years, and we now obtain others which I do not remember seeing previously. This may be partly due to mere annual variation, which certainly is considerable, and it would need much more extended observations to be sure that there is a change of a more permanent character.

In almost all cases my aim has been to collect only such objects as could be efficiently mounted as transparent lantern slides, and I have paid little or no attention to such as were too minute or too large, or otherwise unsuitable for that purpose. I have entirely neglected many important groups of animals and microscopic plants. It will thus be seen that what I can now give is only a very imperfect sketch of the Natural History of the district as a whole.

The chief objects collected when floating past the yacht are the common *Medusæ* (*Aurelia* and *Cyanæa*). *Rhizostoma* probably occurs, though comparatively rarely. The pretty little *Cydippe* is sometimes common and small. Crustaceans like *Idotea* may be caught.

In the Pyefleet the interesting tube-building Worm, *Sabella*, used to be very abundant, but is much less so now, and many Ascidians can be collected on the shores, chiefly belonging to the genera *Ascidia* and *Cione*. The most usual compound *Ascidian* is *Botryllus*. Sometimes a few kinds of *Actiniæ* may be seen attached to the stick-beacons. Along the shore of the Colne at low water, on the east side above Brightlingsea Creek, there is in some years an extensive growth of large *Algæ*, and amongst them a number of interesting things may be collected. Very fine *Sabellæ* are common, and large *Terebellæ* can be procured.

For many purposes the entrance to Blakestone Hole is an excellent collecting ground. When the tide is low several Compound Ascidians and more than a dozen species of large marine *Algæ* can be obtained from the shallow water running out, and entangled amongst them may be found many specimens of *Pygnogonum*, and a number of small crustaceans. From the sand-banks may be dug out several species of worms, amongst the chief of which are *Terebella*, *Nephthys* and *Nereis*. Somewhat higher up, *Arenicola* abounds, and the Mollusc *Pholas dactylus* occurs, boring into the black clay. I think I once found the worm *Cirratulus borealis* in the clay of the bed of the stream.

From the mud in St. Osyth Creek several kinds of worms may be be obtained, amongst which *Nephthys* and *Nereis* are the most common, some of the latter being of an unusually green colour. The most common molluscs are *Scrobicularia piperata* and *Tellina solidula*.

I feel sure that this is a very imperfect list and that many other things must occur.

My dredging and trawling operations off Mersea have been mainly confined to the sea which lies towards the west, outside the 2nd and 4th Floating Beacons, since, in that part there is a fairly clean bottom. Nearer Mersea we usually come to mud, and further out than the 4th Beacon there is much sand. One of my chief objects in dredging has been to collect sundry species of *Algæ* attached to small stones, which will live fairly well in my aquaria. A number of interesting species can be obtained, but on the whole this district is strikingly inferior to the coast of Devonshire, and even to the Orwell and Stour rivers.

I do not think some animals can be so common as they used to be, such as the small worm *Lepidonotus squamatus* and a small purple *Nudibranch*, of the genus *Eolis*. *Doris*, however, is still met with, and the small worm *Polynoe*.

Amongst the most common objects are *Philine* (a Gasteropod with internal shell), the common Shore-Crab, the Hermit Crab, two species of Spider Crab, Shrimps, Prawns, and the two "Star-fishes," *Uraster* and *Solaster*. The Swimming Crab is not common. Past the 4th Beacon, where the bottom is sandy the common Sand-stars, *Ophiura texturata*, are very common, and in some places *Alcyonidium glomeratum*, called "Pipe-weed" by some fishermen, was, and probably still is, very abundant.[1]

Sometimes amongst the Algæ dredged for my aquaria, there must have been small individuals of a *Nereis*, which builds tubes amongst them, and afterwards grew to a fair size; whereas, in other years none of these occurred, but, on the contrary, a considerable number of a species of *Heteronereis* which I had caught quickly swimming on the surface of the water at Queenborough, but never could find where it usually lived. It thus turns out to build tubes amongst the larger Algæ and to be common only in particular years and it occasionally swims at the surface.

BRIGHTLINGSEA HARBOUR AND MOUTH OF THE COLNE.

Beyond Oysters, Mussels, Whelks, Dog-whelks, Periwinkles, *Rissoa* and a small *Trochus*, the number of Testaceous Mollusca dredged alive is extremely small; but, judging from the dead shells, a number of other species must now live, or did live not long ago, somewhere in the district. Amongst the most striking is a somewhat pretty bivalve, perhaps *Tapes decussata*, which can be procured alive from the mud off Mersea.

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[1] This species is often cast up in great quantities after a high tide, on to the shore at the 'Hard," at East Mersea.—W. COLE.

If, in years gone by, I had anticipated that I should ever write such a paper as this, I should have prepared a correct list of everything I found. I feel that what I have now done in these notes is very incomplete, and that I have seen many forms which I cannot remember, since they did not seem of particular interest for my own special purposes, or because I can obtain them so much better in other localities.

NOTES ON THE FOOD OF OYSTERS IN ESSEX.

By H. C. SORBY, LL D., F.R.S., F.L.S., &c.

[*Read September 9th, 1897.*]

SOME years ago I was led to think that very much remained to be discovered with regard to the food of oysters in different localities. No reliance can of course be placed on the examination of the contents of the stomach after the oysters have been kept for some hours out of the natural water, since the food would be digested; and the sooner they are examined the better. When lying in the yacht at Paglesham, I had a good opportunity for studying this question, since my friend Mr. James Wiseman gave orders to his men to supply me with oysters, which were brought to me and the contents of the stomach examined with a microscope, only a few minutes after having been taken out of the water, so that some of the Diatoms they had eaten were still alive. I found that at Paglesham the chief, if not the entire, food was Diatoms. Soon afterwards I had the opportunity of observing oysters taken out of Brightlingsea Creek, and which were examined as soon as I could, but not so immediately as in the case of those at Paglesham. I was surprised to find that the food of the Brightlingsea oysters was very different. Diatoms were few in number, or absent, but on the contrary, the stomachs contained many small animals, which I took to be Infusoria, or small larvæ, not easily identified. At all events the contrast in these two cases was so great as to readily explain why the growth and flavour of oysters fed in different waters may be so different. Since then my attention has been directed to other matters, and in any case I could carry out this work only in an intermittent manner, but I most strongly commend the study to anyone who has the needful facilities, and who could examine the oysters of different localities fresh from the water at every season of the year. It seems to me that by this means much valuable information might be learned.

PLANT COMPANIONSHIP (SYMBIOSIS) IN THE FOREST.

By Prof. G. S. BOULGER, F.L.S., F.G.S. (*Vice-President*).

[*Being Abstract of an Address delivered at the Meeting in Epping Forest, on July 10th, 1897.*]

AMONG the plants we have seen to-day are several illustrative of certain recent conclusions as to mutual dependence (*Symbiosis*) among plants. It has long been recognised that, in addition to those familiar normal independent plants—plants with well-developed roots in the soil and green leaves exposed to light and air, for which some years ago I proposed[1] the name "autophytes,"—there are various other types of nutrition, for which I proposed the collective term "heterophytes," plants of more or less abnormal nutrition. There are the familiar parasites, with reduced leaves and little or no chlorophyll, such as the Broom-rapes (*Orobanche*), the saprophytes, similar in aspect but living mainly upon decaying organic matter, such as leaf-mould, of which the Bird's-nest Orchis (*Neottia nidus-avis*) is a characteristic example, and the insectivorous plants, such as the Sundews (*Drosera*), with reduced root systems, and dependent largely upon nitrogenous food of animal origin.

But, besides these familiar types, there are others, some of which are of an interestingly intermediate character. The nutritional abnormalities of which I wish mainly to speak at present have reference to two chemical elements the two most characteristic of organic beings—carbon with its capacity for forming complex and polymorphic compounds, and nitrogen with that distinctive inertness which renders so many of its compounds unstable even to the degree of explosiveness. Most educated people, even those with no special knowledge of physiology, are familiar in a general way with the usual method in which the autophyte obtains its carbon, how the protoplasm in the presence of chlorophyll and under the influence of sun-light decomposes the carbon dioxide of the atmosphere; but the connection between a partial cessation of this chlorophyllian function and a partial degradation of the chlorophyll has not been so widely noticed. Young oak-leaves in spring are, as you know, as red as many leaves and ripening fruits in autumn; a similar reddening, perhaps from the presence of that *chlorophyllan*, possibly an oxide, which forms on exposure in an alcoholic solution of chlorophyll, is common in the leaves of Sundews and in those of various Pitcher-plants; and it exists, under a more purple form, in well-known varieties of the Beech and the Hazel, and very frequently in the leaves of the Cow-wheat (*Melampyrum*). Now this last-mentioned plant—common on the Forest belongs to a sub-order of the Scrophularinæ, to which belong also the Yellow and Red Rattles, the Bartsia and the Eye-brights, which are well known to be partially parasitic upon the roots of grasses; and it is also partially saprophytic, flourishing among decaying leaves and clinging with copious rootlets to any chance fragment of manure. The two trees I have mentioned as having purple-leaved varieties belong to the Cupuliferæ, as also does the Hornbeam (Figs. 1 and 2); and this order, together with the Salicineæ and the Coniferæ (three groups which include a large proportion of our forest trees), are characterized by the absence of hairs on their roots, the place of such hairs being apparently supplied, or more than supplied, by the presence of a mass of fungal threads or hyphæ known by the provisional name *mycorhiza*. It is noteworthy that the "richer" the soil, *i.e.* the more humus it contains, the more abundant is this mycorhiza. In the case of these trees it may be the mycelium or spawn of the truffle-like genus *Elaphomyces*, which is, I am informed, collected on this Forest as an esculent by the German inhabitants of the East-end. In their case too, it is mainly what is termed *ectotropic*, *i.e.*, not penetrating the roots, whilst in the Heath tribe Ericaceæ and Orchidaceæ, in which a similar growth occurs, it is *endotropic*, actually penetrating the roots like a parasitic mould. Contrary, however, to what might have been expected, it has been experimentally demonstrated by Frank that the presence of mycorhiza is beneficial to the flowering-plants on which it occurs; and it would seem that it may absorb and transmit to its host-plant some of the carbon-compounds present in humus, thus to some extent rendering chlorophyll unnecessary, and perhaps explaining the manurial value of humus which has been a fruitful subject of debate among physiologists from the time of Liebig.

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[1] "Plant Nutrition," *Gardener's Chronicle*, vol. ix. (1878.)

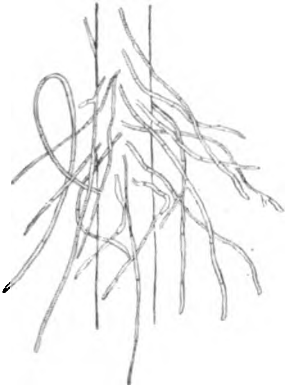

FIG. 1. Mycorhiza or projecting ends of hyphæ on young root of hornbeam

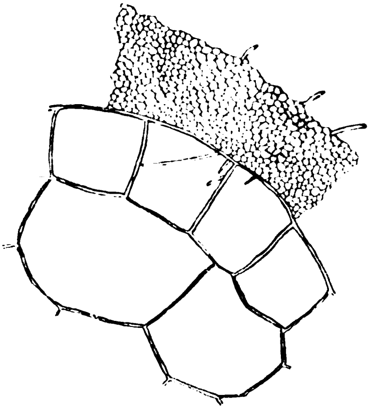

FIG. 2. Part of cortex of root of hornbeam, with mycelial mantle. (Transverse section).

As to nitrogen, it is well-known that the ordinary higher plants do not assimilate this gaseous element in the free state in which it exists in the atmosphere; and it has been shown that they do not as a rule take it in as soluble ammonium-compounds, as might well be supposed, but as nitrates. The phenomenon of nitrification, or the formation of nitrates in the soil, was found to present all the features which are distinctive of those processes known as fermentations in which a micro-organism is present, being, for instance, inhibited by the use of antiseptics. It was then traced to the action of various Bacteria belonging to the genus *Rhizobium*, which are found to convert ammonium-compounds into nitrites, and, by a further process of oxidation, to convert nitrites into nitrates. A most interesting recent extension of this enquiry, however, points to the actual assimilation of the free nitrogen of the atmosphere by these Nitro-bacteria, as they are collectively termed. I allude to the functions of the root-tubercles which are present in all members of the Pea-family (Leguminosæ), as, for example, in the Clover (Figs. 3-7). These gall-like tubercles, formed of hypertrophied cortical tissue on the lateral roots, result from the attacks of a fungus through the root-hairs. The poorer the soil is in combined nitrogen, the more numerous and the larger are the tubercules. The cells of the tubercles are rich in starch and sugar, and most of them are penetrated by branches of the fungus-mycelium. These branches "abstrict" or bud-off innumerable gemmules, which may probably be correctly termed gonidia, resembling, as they do, those of a common mould, like *Eurotium aspergillus*. (Figs. 6-7). So similar are these gemmules to Bacteria that they are called "bacteroids," and it is doubtful whether in this case the presence of any true Bacteria as

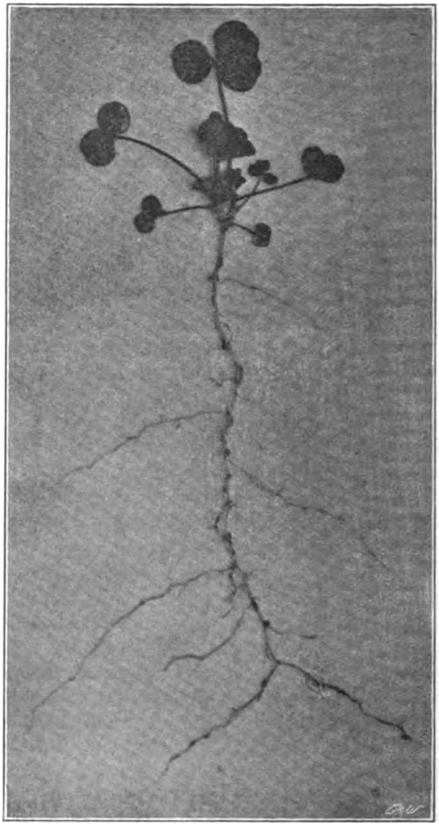

FIG. 3. Seedling clover plant showing nodules on the roots.

well is essential to the process. In the presence of glucose—the sugar present in the cells of the tubercles—the Nitro-bacteria or bacteroids seem to have the power to assimilate free nitrogen from the air in the soil, and the plant appears to consume these bacteroids with their contained resultant nitrates ; whilst, as the tubercles become disorganised, the released bacteroids infect other roots, Though our knowledge of the whole process is as yet far from complete, it is obviously one of primary importance to agriculture, indicating as it does one of the most valuable functions of leguminous crops ; and at the same time it would be difficult to find a more interesting example of the mutual dependence of plant lives.

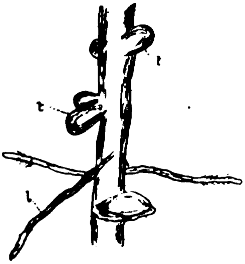

FIG. 4.

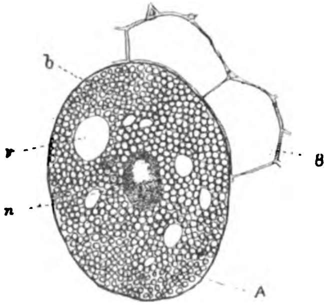

FIG. 6.

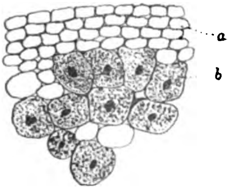

FIG. 5.

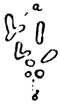

FIG. 7.

FIG. 4. Portion of clover root showing (*t*) tubercles and (*l*) root-branches.

FIG. 5. Fragment of tissue from tubercle of root of clover (magnified); (*a*) peripheral cells ; (*b*) infected cells, strongly uncleated.

FIG. 6. One of the infected cells (A) from the root-tubercle of clover; *n*., nucleus ; *v*., vacuole ; *b*., bacteroids ; B , ordinary cells (much magnified)·

FIG. 7. Isolated bacteroids *a*., from younger tubercles ; *b*., from older tubercles (much magnified).

[For the loan of the figures illustrating this Address the Club is indebted to the courtesy of the Editor of *The Journal of the Essex Technical Laboratories*.]

THE ESSEX FIELD CLUB.

FIELD MEETING IN EPPING FOREST.

SATURDAY, JULY 10TH, 1897.

Conductors:—PROF. G. S. BOULGER, F.L.S., F.G.S., S. A. SEWELL, Esq., F.R.H.S., F.R.G.S., and the HON. SECRETARIES.

THIS meeting was intended to combine a Botanical Demonstration with the usual summer ramble in the Forest, looking its freshest and greenest during the early days of July, the anticipated plague of Spring caterpillars having been checked by some natural cause.

The route of the ramblers covered the ground around Loughton Camp, Monk Woods, Wake Valley, and Honey Lane Quarters, some of the pleasantest parts of the woodlands, a very large attendance of members and friends was obtained--between 80 and 90 being present at the rendezvous, in the Green Ride, between Staple's Pond and Black Bushes, at about three o'clock. The way up the rising ground into the Loughton (or Cowper's) Camp was taken, and there a halt was called for some little time to enable stragglers to assemble, and to allow of a little botanical and entomological collecting. Mr. W. Cole gave a brief description of the Camp, and of the explorations conducted by the Club there in 1882, of which a Report, drawn up by himself, with plans, &c., was published in the *Transactions*, Vol. iii., pp. 212-230.

As regards the botanical features of the walk, Mr. Sewell, one of the Conductors makes the following observations, including therein a few remarks on the floral aspect of the Forest in the earlier months and later: —

"The most striking feature of the Forest at this time of the year is the blossoming Roses and Rubi or Brambles. The former are chiefly represented by the lovely small White-rose (*Rosa arvensis*). This appears either in large independent bushes, or trailing over other shrubs, such as the Blackthorne or springing up as small plants close to the ground. In the former case there are generally masses of flowers and buds, in the last sometimes a single flower of large size. This species is more common in the Forest than the Dog-rose, which is far more abundant as a rule, but which we occasionally met with clothed with its beautiful pink buds and flowers.

"The St. John's Wort, *Hypericum pulchrum*, was occasionally met with also the Cow Wheat (*Melampyrum pratense*), which though somewhat local, is to be found occasionally all over the Forest.[1]

"The *Tormentilla*, which has been so very profuse in the early summer covering large spaces with its small yellow blossoms, but appears as a straggler, and is giving place to its larger relations the *Potentillas* both *reptans* and *anserina*. *Galium saxatile*, the smooth Heath Bedstraw which has also been exceedingly abundant, is dying out, and being replaced by the handsome Yellow Bedstraw (*G. verum*), of which we saw some fine examples. The Marsh Red Rattle was nearly gone, but in some marshy places the beautiful Ragged Robin was springing among and above the rushes, revealing its delicate blossoms.

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[1] It is abundant in Lord's Bushes, and was interesting to us on the present occasion inasmuch as it is one of the semi-parasitic plants specially alluded to by Prof. Boulger in his address on Symbiosis.--ED.

"In the spring the immense family of the Compositæ takes almost the earliest place among wild flowers, by putting itself in evidence with the Coltsfoot (*Tussilago farfara*) and the Dandelion. When these are gone it has hardly a single representative. Then there is an interregnum till in May the pretty pale yellow Mouse-ear Hawkweed begins to deck the heaths and waysides with its pale golden flowers. This plant, by-the-way, is quite a feature in same parts, and I never saw it so fine or so abundant as it has been this year on Warren Hill. Well, just about that time it was almost the sole representative of the 140 British species of the Compositæ. Now it is giving way to the larger Hawkweeds, and several are springing up under the shade of the trees. Before long the whole order wil be in evidence everywhere, and the country will be covered with Ragworts, Wormswoods, Thistles, Fleabanes and other representatives of the tribe, but as I said they show themselves very sparsely in the early year.

"Before long we may look forward to the Heathers, and on Saturday we were delighted to find some nice flowers of the most beautiful of all our three common Heaths, *Erica tetralix*. When its more common brother *E. cinerea* and its cousin the common Ling (*Calluna vulgaris*) are in flower the Forest will be clothed with a glorious purple.

"Of the Ranunculaceæ the sole representatives were the lesser Spearwort, *Ranunculus flammula*, which comes in as the last of the Buttercups, and on the ponds varieties of *R. aquatilis*. This species has been subdivided to a great extent, and I feel sure that if anyone were to investigate the Forest ponds he would find a good many of the sub-species.

"Among the Leguminosæ *Lotus corniculatus*, and *L. major* (the Lesser and Greater Bird's-foot Trefoils) were met with, the former in large orange yellow patches, and the latter climbing the bushes; while here and there we detected the delicate Bitter-vetch, *Orobus tuberosus*. Self-heal (*Prunella vulgaris*) was frequent but very dwarfed. In favourable places this plant becomes large, vigorous, and really handsome, while on a lawn it will bear constant cutting, and become like several other lawn plants perfectly minute."

The walk was continued through Monk Woods, and by the "Wake Arms" to Honey Lane Quarters, to the high ground by the old rifle-butts, to a spot overlooking the Lea Valley, which had been selected as a good pitch or the tent in which tea was to be served. By a mistake of the Contractor's (Messrs. Riggs) men, the tent had been pitched at the Waltham Abbey end of Honey Lane Plain, and it was some little time before it was discovered by the hungry naturalists. However, the spot was very retired and pleasant, and an ample and well-served meal made amends for a somewhat prolonged ramble.

After Tea an ORDINARY MEETING of the Club (the 170th) was held, Mr. David Howard, President, in the Chair.

The following were elected members:—Mr. John Bull, Mrs. W. Cornish, Mr. Charles Green (*Roy. Inst. Water Colours*), Mr. James Jones, Mr. H. Watts Mason, Mr, G. R. Matland, and Mr. F. B. Wrightson.

The Hon. Secretary called attention of the Club to the fact that the Uphall Estate, near Ilford, was for sale; this include not only the celebrated ground out of which Sir Antonio Brady dug his magnificent collection of Pleistocene Mammalia, now in the British Museum of Natural History, but also the site of the Barking or Uphall Camp which was thus threatened with destruction. Mr. Cole thought that some efforts should be made to prevent such a misfortune, which would be a serious blow to local archæology. He understood that the Society of Antiquaries were intendsng taking some action in the matter, and several people had written to him on the subject. The Secretary was instructed to write to the Society of Antiquaries and to other bodies, and to report later. (*See ante* page 143).

Mr. Eliot Howard exhibited specimens of Native Oyster Shells from Glevum Colonia (Roman Gloucester). excavated from the officers' quarters by Mr. John Bellews. Common Welsh oysters only were excavated from the men's quarters. Mr. Howard thought it very interesting to find such trace of commerce between Camalodunon in Essex and Roman Gloucester. (See note on page 141, *ante*).

Prof. Boulger then delivered an Address on the subject of "Plant Companionship (Symbiosis) in the Forest," of which an abstract is printed on another page.

A vote of thanks to Prof. Boulger was proposed by the President, and seconded by Prof. Meldola, who in doing so made some very interesting remarks on recent researches relating to symbiosis, and especially as to the action of the nitro-bacteroids alluded to by Prof. Boulger. The vote was carried by acclamation.

On the proposal of Mr. T. Hay Wilson, a vote of thanks was also passed to the Secretaries in recognition of their care and trouble in arranging the meeting, and afterwards the members and their friends rambled back through the Forest to Loughton and Chingford Stations

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RECEPTION BY THE RIGHT HON. THE COUNTESS OF WARWICK AT EASTON LODGE, AND VISIT TO BISHOP'S STORTFORD AND HATFIELD FOREST,

WEDNESDAY, JULY 21st, 1897.

CONDUCTORS—

Archæology, G. E. PRITCHETT, F.S.A., and J. L. GLASSCOCK, Memb. E.A.S.; *Botany*, Prof. G. S. BOULGER, F.L.S., F.G.S.; *Entomology*, C. G. BARRETT, F.E.S., and Prof. R. MEDOLA, F.R.S., V.P. Ent. Soc.; *Geology*, W. WHITAKER, F.R.S., F.G.S.; *Zoology*, J. E. HARTING, F.L.S., *General Conductors*, W. COLE, F.L.S., F.E.S., and B. G. COLE.

A MOST enjoyable and very largely-attended Meeting of the Club took place on the above day. The weather was glorious, and the terrific thunderstorm so severely felt elsewhere happily spared the district visited, not a drop of rain falling during the day, though the distant thunder was heard rumbling from time to time and masses of dark cloud were seen on the horizon.

The Meeting was planned to afford an opportunity of visiting a district but little known to the majority of its Members, and to take advantage of the kind invitation of the Earl and Countess of Warwick to the Club to visit them at their charming residence, Easton Lodge. Occasion was also taken to place before the Members the importance of the vigorous and widespread efforts now being made to hinder the rapid effacement of many interesting species in our British Fauna and Flora, more especially among the class of insects and some of our local plants.

The greater number of Members assembled at about 9.30 at Bishop's Stortford Station on the arrival of the 8.45 train from London. A wait of nearly an hour was necessary for the arrival of Members from Colchester, Maldon, and Chelmsford; but there was much to be done in the time.

On arriving at Bishop's Stortford, the party proceeded to the site of Waytemore Castle, where they were met and hospitably entertained by Mr. Marshall Taylor. Mr. G. E. Pritchett, F.S.A., conducted the party over the site, pointing out the probable position of the Castle buildings, of which there are now no remains above ground, and also the remains of the outer wall of the Keep which are still to be seen on the summit of the Mound to the N.E. of the site of the Castle.

As Waytemore Castle was so well described by Mr. Edward Taylor, F.L.S., on the occasion of the visit of the Essex Field Club in 1888 (see ESSEX NAT., vol. ii., pp. 221-224), it will not be necessary to repeat the description here.

The chief object of interest is the Mound itself, upon which the Norman Keep was subsequently built in the 11th century.

The history of the Mound is still involved in obscurity. We may, however, at once dismiss the idea that it was raised by William the Conqueror, for the purpose of building his Keep upon it, although Chauncey's remark in his *History of Hertfordshire* might lead one to think that the notion was prevalent in his day. Whether the Saxons made use of it or not we do not know, probably they did; but we have evidence that the Romans occupied the site, and some competent judges have given it as their opinion that the Mound is pre-Roman.

The position, in marshy ground, in the centre of the valley, with the river flowing all round it, would appear to point to the idea that its original purpose was one of defence, and not of burial. This doubt as to its origin can only be satisfactorily solved by careful excavation under competent superintendence. We trust that the present owner (Mr. Marshall Taylor) will be willing to consider this suggestion if he is approached upon the subject.

On the proposal of the President, Mr. Howard, a cordial vote of thanks was passed to Mr. Marshall Taylor, for his kindness to the party.

On leaving the Castle, the visitors inspected the "Black Lion," in Bridge Street, and the "White Horse," in North Street, both good specimens of late 16th century building.[1]

At the "Chequer's Inn," in North Street, the already considerable party was greatly augmented by the arrival of the Mid- and North-Essex Members.

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[1] The above notes were courteously given to the Editor by Mr. Glasscock, one of the Conductors of the day.

Soon after half-past ten o'clock, a start was made in a large number of wagonettes, for Hatfield Forest, permission to ramble through it having been given by Col. Archer Houblon. The route was by Hatcham Bank and Woodside Green, to the gate of the Forest opposite "Wallwood Piece," where the conveyances were quitted, and the woodland ramble commenced.

It was the third visit of the Club to the Forest, and some information respecting its history and natural history will be found in the reports of former meetings in the ESSEX NATURALIST (vol. iii., pp. 225-226 and vol. iv., pp. 218-225). The Forest comprises about 1,000 acres; it was anciently a royal demense, and originally no doubt formed part of the great Forest of Essex. Hatfield is a corruption of the Saxon "Heethfield," land covered with heath or underwood. The Forest contains many fine oaks and other trees, notably some grand hawthorns which could scarcely be matched anywhere for size and beauty. From many branches hung abundant stores of mistletoe, a very welcome botanical sight. Hornbeams, which are so characteristic of the older Essex woodlands were also seen. The whole tract is beautiful and picturesque, especially when the numerous fallow deer are seen bounding along in the distance. Details of the small herd of Red Deer, all the offspring of a single hind hunted into the forest in 1875 and lost by the hounds, will be found in the ESSEX NATURALIST, vol. i., 189.

By the lake near the "Grotto," built in the "elegant" style of the 18th century, with quaint ornamentation worked in flint and shells (figured in a former report), Mr. W. Whitaker, F.R.S., gave a brief address on the Geology of the district, more particularly alluding to the Chalky Boulder Clay, which covers so much of the surface in the district. In the cottage hard by was seen a specimen of a Gyr-falcon recently trapped by the keeper in the forest.

Some fine specimens of the bivalve *Unio pictorum* (or "Painter's-mussel") were taken from the lake by Messrs. Hughes and Webb; this species is recorded in Mr. Webb's paper (*ante* p. 78) on the authority of Mr. Hughes and Mr. Miller Christy, but was not noticed on the previous visit of the Club, while *Unio tumidus*, then noted, was not found on the present occasion.

Thence, under the guidance of one of the foresters, a man still of fine physique and great strength, though he has been employed in these woods for fifty-six years, the party went to visit what is left of the Doodle Oak. There is little more of it than there is left of the Martyr's Oak at Brentwood, but it is secured within a space guarded by iron railings, and beside it grows an oak, sprung from one of its own acorns, which bids fair to become a magnificent tree. The word "doodle" is significant; it means alimit, or boundary, or landmark—much as in the word "dole-stone," for instance. It is, perhaps, the oak from which Hatfield derived its name of Hatfield Broad Oak; at any rate, the remains bear a striking resemblance to the drawing given in Young's *Agriculture* in 1813. Within a few yards of the decaying tree, and inside the enclosure, stands a successor, believed to have sprung from an acorn dropped from the parent oak.

A visit was also paid to "Beggars Hall Coppice" in which is a circular entrenchment, and a small spot of ground called "Porting-hills" or "Portingbury-hills"; nothing is known of these remains, nor has any attempt yet been made to ascertain their nature or period of construction.

The flora of this part of the forest appeared to be exceeding rich and varied, but the Conductor's urgent whistle prevented any real collecting being done. Everyone was charmed with the rich expanse of the growth of one or two species of St. John's Wort (*Hypericum*). *Orchis pyramidalis* was seen, and *Cynoglossum* was again much in evidence (see a short list of the Forest plants at p. 222 of vol. iv., E.N.)

Leaving the Forest, the party drove to Easton Lodge, through Takeley-street on the Roman-road ("Stane-street") from Colchester to St. Albans. The fine avenue through which the long road runs from the park gates to the house was greatly admired. The park is beautiful, with fine trees, great herds of deer, myriads of rabbits, and abundance of birds. Turning a bend, the visitors found themselves in front of the house, a building of much dignity and beauty. It was built in 1595 in the Elizabethan style. In 1847 a large portion of the centre of the mansion was destroyed by fire, but was afterwards rebuilt at a cost of £10,000. At the east end is a chapel built by William, Lord Maynard, in 1621. The house contains some good portraits of the lords of Easton, painting of Charles I. by Vandyke, and others by Sir Joshua Reynolds, &c. The views from the mansion are very fine, and the park comprises 1,200 acres, containing a beautiful lake and some grand timber. The church, probably a 13th century structure, stands in the park, and contains some notable monuments, *e.g.* Sir Henry Maynard (1610), secretary to Lord Burleigh; Isabella of York and her husband, Henry Bourchier, Earl of Essex (1483). Also a brass of Robert Fyn, a priest, in his vestments, (1420). Roman remains have been found in the neighbourhood.

The party of nearly five score guests were welcomed with graceful cordiality by Lady Warwick in the gardens at the north side of the house. A sumptuous luncheon was served in a large marquee erected in the grounds. Lady Warwick presided at the repast, and at the conclusion the President and Professor Meldola appropriately acknowledged the hospital reception of the Club. The Countess of Warwick expressed her pleasure at seeing the party and her regret that Lord Warwick was away from home and therefore unable to welcome the guests. She hoped that the members would make the best use of their time in the grounds during their stay, and invited those interested in education to accompany her in the afternoon on a visit to her Technical School at Bigods farm.

On the lawn on the north side of the mansion—a lawn from which a commanding prospect delighted the eye, the splendid woodland scenery of the Chelmer Valley stretching away far into the hazy distance where the slender spire of Thaxted Church (the "Cathedral of Essex") could just be seen peering over the distant trees—was a charming and spacious tent, beside which a stately cedar of Lebanon kept guard. In this drawing-room tent the company assembled, and there the 171st ORDINARY MEETING of the Club was held, the Countess being present with Lady Margery Neville during the proceedings.

The President (Mr. David Howard) occupied the chair. The following were elected members:—Mr. C. C. Buck, Mr. H. J. Kimble, Mr. Henry Laming, Mr. Thomas Ryley, Mrs. M. Robinson, and Mr. A. Godfrey Wells.

In a few words the President introduced the subject which had been set down for the special consideration of the Meeting, viz.: —"THE PROTECTION OF OUR NATIVE FAUNA AND FLORA FROM THE DESTRUCTION AND ACTUAL EXTERMINATION WHICH NOW THREATEN MANY INTERESTING SPECIES."

Mr. Charles G. Barrett (Hon. Sec. to the Committee of the Entomological Society for the Protection of Insects in danger of Extermination), introduced the subject of the destruction by *over-collecting* of some of the most local species of British Lepidoptera. He instanced the raid, last year, upon the newly discovered locality for *Polyommatus arion* (the "Large Blue Butterfly") in Cornwall, where more than 2,660 specimens are estimated to have been destroyed, single collectors in one or two cases taking from 500 to 700 each. This had not been with any intention of making butterfly pictures like those of the Spitalfields weavers, nor on the other hand with any idea of liberally distributing specimens to those entomologists who had no opportunity of visiting the locality, but solely for the purpose of exchange by the modern "basket" system probably, and of hoarding away in the hope that the species would again become rare and of a high money value. The cases of *Melitæa athalia*, formerly a well-known Essex species, but now nearly or quite extinct; and of *Apatura iris*, which had been destroyed in some of its haunts by systematic and combined efforts of collectors, were also cited.

So great a public feeling of indignation had been aroused by these and similar outrages that the Entomological Society of London had appointed a Committee to consider what means should be taken for dealing with the subject. This Committee, after careful deliberation, had come to the conclusion that legislation for any such purpose is not at present within the range of practical work; but that something might be done by bringing to a focus the general feeeling of indignation at the outrageous greediness of a certain class of collectors, and for this purpose they had drawn up a Memorandum of Agreement whereby members bound themselves not only to the practice of moderation in their own collecting and care that they should do nothing likely to tend towards the extermination of rare insects, but also to the exercise of their influence over others in the same direction.

This Memorandum (of which the following is a copy) had been adopted and extensively signed by the principal Entomological Societies in London and the provinces, and it was earnestly hoped that by this means the extermination of those species which were in no way injurious to agriculture, but which, being on the extreme verge in these islands of their natural range, and therefore able to exist only in the most favourable spots, might be prevented:—

"MEMORANDUM OF ASSOCIATION FOR THE PROTECTION OF INSECTS IN DANGER OF EXTERMINATION.

"We, the undersigned, being desirous of protecting from extermination those rare and local species of insects which are not injurious to agriculture nor to manufactures, do hereby agree by our example, and by the exercise of our influence over others, to discourage the excessive collecting and destruction of those species of insects which from their peculiar habits or limited range are in danger of extermination in the United Kingdom.

"We further agree to accept for the purposes of this Association such list of species in need of protection as shall be drawn up, and if necessary from time to time amended by the Committee of the Entomological Society of London appointed to that end."

First List of Lepidoptera suggested for Protection.

Papilio machaon, L.
Leucophasia sinapis, L,
Pieris cratægi, L.
Melitæa athalia, Esp.
Melitæa cinxia, L.
Apatura iris, L.
Liminitis sibylla, L.
Polyommatus arion, L.
Cyclopides paniscus, Fab,
Hesperia actæon, Esp.
Trochilium scoliæformis, Hüb.
Zygæna meliloti, Esp.
Zygæna exulans, Hoch,
Nola strigula, Schiff.
Nola albulalis, Hüb.
Nola centonalis, Hüb.
Eulepia cribrum, L.
Liparis chrysorrhœa, L,
Clisiocampa castrensis, L.
Drepana sicula, Schiff.
Dipththera orion, Esp.
Acosmetia caliginosa, Hüb.
Dianthæcia irregularis, Hufn.
Plusia orichalcea, Fab.
Epione vespertaria, L.
Fidonia conspicuata, Schiff.
Scoria dealbata, L.
Cidaria reticulata, Fab.
Lithostege griseata, Schiff.
Agrotera nemoralis, Scop.
Pterophorus rhododactylus, Schiff."

Mr. J. E. Harting (*Secretary to the Linnean Society, and late Editor of the "Zoölogist"*) continued the discussion from the point of view of Mammals and Birds. He said: "I think that I shall be only echoing the sentiments of many present in expressing the gratification afforded to members of Field Clubs, such as ours, by being permitted to ramble through such beautiful woodlands as we have seen to-day, and to visit such historically and archæologically interesting places as Easton Lodge. It is in the course of such rambles that we are enabled to view some of the most beautiful natural scenery of England, which, thanks to the fostering care and good taste of the owners has remained unaltered through all the changes that have affected land near great towns and centres of industry.

"One thing only they have been unable to preserve—that is in its entirety—the ancient fauna, the beautiful wild creatures (Mammals and Birds chiefly, but some Insects also) which are gradually disappearing, and have already disappeared in many places through the senseless persecution of them by those who should know better.

"Acts of Parliament and orders of the Home Secretary obtained through the intervention of County Councils, are all very well up to a certain point; but when through excess of zeal and want of knowledge, species are ordered to be protected in summer which are only found here in winter, and people are forbidden under a penalty to take in their own county the eggs of birds which never breed there, the law is brought into contempt, and stands a good chance of being completely disregarded. This is more than ever likely to be the case now that County Councils have obtained protection for different birds in different counties between different dates; so that at the present time the law relating to the protection of wild birds and their eggs is in a hopeless state of confusion. Years ago I pointed out in print that there was no necessity to forbid the taking of eggs; all that was needed was to enforce the law of trespass, and the law which prohibits the killing of the parent birds during the breeding season. If this were done, the taking of a few eggs would do no appreciable harm.

"I am one of those who think that more good is likely to result from proper instruction in natural history given at elementary and technical schools than from an attempt to enforce Acts of Parliament and Orders in Council which cannot but be repugnant to all high-spirited schoolboys.

"But there is another course open which has been productive of so much good in localities where it has been tried, that it deserves wider recognition. I refer to the examples of those landowers who have become convinced of the necessity of thinking for those dependent upon them who will not, or do not, think for themselves. We know too well from experience what is usually the result when a gamekeeper is permitted to carry a gun and shoot what he likes. In most cases when a keeper is allowed to use his own discretion he speedily proves that he has none. He too often has no knowledge of the habits of the creatures which he destroys, and evinces no sort of curiosity to learn anything at all about them. All he knows is that they cross his path and, not being game, he slays them. It behoves the employer of such a man to look after him and put a check upon his destructive propensities. This has been done in several places I could name, and with the best results. In Scotland the Osprey, as a breeding species, has been saved from extermination by Donald Cameron of Lochiel, by Sir John Grant of Rothiemurcus, and by Lady Ashburton at Loch Luichart in Ross-shire. Similarly the Golden Eagle is protected at Glen Tana by orders of Sir William Cunliffe Brooks. At Bishopswood, Herefordshire, the keepers of Mr. H. M'Calmont have been reprimanded for killing Honey Buzzards, and have now strict orders to leave all such birds as appear new and strange to them unmolested for the future. The Golden Oriole, a regular spring visitor, is so well protected in Kent that it has been my good fortune to see the hen-bird sitting on her nest within a short distance from the house of her protector. If the example of these proprietors were more generally followed in other parts of the country, and landowners, instead of leaving everything to chance, would ascertain what species should or should not be protected and give directions accordingly, we shall once more see the woods and fields tenanted by creatures that have long been banished, and rejoice in the observance of the motto 'Live and let live.'"

Prof. G. S. Boulger, F.L.S., then spoke from the botanical side, on the EXTERMINATION OF RARE AND COMMON PLANTS. He said: "There are indisputably causes of extermination that are inevitable, such as the spread of building operations and agriculture, with the draining, weeding, and grubbing up of noxious plants or of too voluminous hedgerows that accompany them. Some of our rarer orchids unfortunately occupied eligible building sites, and the diminished area of fen and marsh land throughout the country has necessarily led to the disappearance of such plants as the Sundews and the Grass of Parnassus from many districts. Farmers can hardly be blamed for rooting up the barberry, the fertile cause of "rust" in wheat, or cottagers for destroying the Deadly Nightshade, the fruits of which their infant children will persist in mistaking for cherries.

"There are, however, several other causes of exterminaton not only of rare, but of common plants that might well be checked. Among these are attempts to transfer wild plants to gardens for the purpose of cultivating them when they are often unsuited for the purpose, the wholesale rooting up or cutting of plants by dealers for sale in the streets of our large towns, and excessive collecting by amateurs. The Mezereon and the Martagon-lily, two Essex rarities recorded by Gibson, are now probably extinct from having been transferred to cottage-gardens; our orchids, most of which are extremely difficult to cultivate, and so require constant renewal, are only protected from the same fate by the fortunate popular delusion that all orchids have spotted leaves; all ferns, except the bracken, have practically disappeared from within a radius of twenty miles round London, though few of them succeed in the sooty gardens of the Metropolis: an unfortunate blunder, which has given it a political significance, threatens the existence even of the common Primrose, except in enclosed grounds; and even so prolific a plant as the Foxglove is in danger of extermination in Epping Forest. The beautiful grey foliage of the Sea-holly, so favourite a subject with artists; the pretty clusters of blossoms on the Guelder-rose in spring, and its limpid red berries and red-tinted leaves in autumn, and the too conspicuous fruit of the Spindle-tree, have led to such a sale of these plants in our city streets as to endanger the survival even of the shrubby species, unless specially cultivated. Our charity should not end at home; and, while it would be well to emulate the example of the Swiss, who now cultivate Edelweiss and other Alpine rarities for the benefit of tourists, we should protest against the wholesale collecting of bulbs, and other rarities in foreign countries by amateurs like Mr. George Maw, who might almost as well be dealers. If we must try to grow Ferns, Foxgloves, and Primroses in London, for instance, it would be better to obtain them from a nurseryman who propagates them than from the vagabond who robs our woodlands.

"I beg to move the following resolution:—

"That in view of the dangers of extermination threatening many beautiful, rare, and interesting plants, all lovers of nature should do their best to avoid this danger—(1) by abstaining from wholesale collecting, collecting for merely private individual collections, needless rooting up of specimens, attempting to cultivate specimens of refractory species, and purchasing such from itinerant or other dealers; (2) by endeavouring to persuade others, especially school children, cottage gardeners, and dwellers in large towns, to a similar abstention."

The President said that all who had listened to the excellent addresses just delivered must have been impressed with the idea that the subject of the protection of our indigenous fauna and flora for the delight and instruction of ourselves and future generations did command the most serious and careful consideration of English men and women. He had great pleasure in seconding Professor Boulger's resolution with regard to plants, and in endorsing what had been so well said by Mr. Barrett and Mr. Harting. Referring to a remark of Mr. Boulger's, he facetiously said that if people only realised what a mean and hideous thing the Swiss Edelweiss was they would spare it on that account. Mr. Howard also remarked that he did not see why, if he were the owner of a hedgerow, anyone should rob him of valuable and rare plants to make money out of them, and to diminish the value of his freehold. He thought that such a person should be amenable to law just as much as if he had dug valuable minerals out of the soil.

Prof. R. Meldola, F.R.S. (*late President of the Entomological Society*), referred to the effects of the Wild Birds Protection Acts which, most beneficial in some respects, in others by excessive encouragement of some kinds of birds tended to the decrease of interesting species of insects. He thought that the greatest benefit would arise from inculcating in young people a sense of the sacredness of *life*, and the positive wickedness of destroying it, excepting under circumstances which necessitated or justified the act.

Mr. W. Cole said that owing largely to the exertions of Mr. E. N. Buxton in obtaining the co-operation of owners of land immediately surrounding Epping Forest, that district was now one of the largest protected areas in England. *All* birds, with very few exceptions, would in the future be there cherished. The effects of legislative partial protection (the raptorial birds being excepted) was visible in many districts, for in consequence of the abnormal increase in the number of insect-eating birds, their insect prey had much diminished. This fact showed that one-sided interference with the balance of Nature might temporarily do harm, but as the raptorial birds again increased he hoped that the due proportion of bird, animal, and insect life in the forest would be restored.

Prof. Boulger's resolution was carried unanimously, and the cordial support of the Club was also given to the scheme of the Entomological Society for the protection of our native INSECTS.

Mr. G. E. Pritchett, F.S.A., made some interesting remarks upon the remains of a maze near Tilty Abbey in this district. Such mazes, it appears, were used as a means of penance in the olden time, the offenders being compelled to crawl along the maze on hands and knees. He referred to Mr. G. N. Maynard's paper on Mazes in the ESSEX NATURALIST for 1897 (vol. iii., pp. 244-247).

The meeting thus terminated, and a tour of the gardens, which were in the full splendour of their summer beauty, was then enjoyed by many, and the aviary was visited, under the personal conductorship of Lady Warwick. She has birds from many parts of the world, and many breed at Easton which fail to do so in the Zoological Gardens. The creature which drew the greatest amount of observation was an Australian Piping Crow, who was evidently disposed to "show off." He threw up his bill, opened it wide, and gave in the richest tones many a bugle-call and snatches of all sorts of tunes from "Pop goes the weasel" (venerable in age) onwards to almost the latest air-catching tune. He gave them in various keys, sometimes embellished them with flourishes, and now and then tacked on at the close a distinctly humourous ending. He was savage, and he was safely shut up, which were fortunate things, for every one present would have liked to steal him! A "Laughing Jackass" was obliged, much against his will, to show himself for a few moments. Lady Warwick remarked that she used to have two of them, and then their odd laugh could be frequently heard; but one died, and the survivor had rarely laughed since. He had made friends with a squirrel, and the two were now inseparable. As a matter of fact, the only way of getting the bird out of its hiding place proved to be by means of the squirrel; when that pretty little creature was turned out to the front, the "Laughing Jackass" followed. But it quickly bolted back again, and its bosom friend hurried after it.

The greater number ot the party drove over to Bigod's Farm, near Dunmow, to visit the Village Technical School, established there by Lady Warwick, who accompanied the party, and explained this unique experiment in practical education. The celebrated Village Art Needlework Settlement and Laundry were also inspected. The President spoke of it as the most interesting and most hopeful village school that he knew of, and this appeared to be the conclusion of the numerous educational experts present.

Returning to Easton Lodge, tea was served on the lawn, and after being photographed, the large party took leave of their kind hostess, and drove through the park under the guidance of Mr. Lister, the head gardener, to the remarkable "Shakesperian Garden," so tastefully devised by her ladyship, its immense sundial with its motto of living box *Les heures heureuses ne comptent pas*, and its countless Shakesperian plants, each appropriately labelled with a quaint and pretty plaque made of Hedingham ware.[1] The picturesque "Stone Hall" in the garden—a museum of mediæval domestic relics and motto crockery was also entered and inspected, and then the long drive over the Stene-street back to Bishops Stortford in the cool of the evening concluded a most enjoyable and successful Field Meeting.

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[1] The garden has been described in a very entertaining way by Lady Warwick, under the title of "My Plaisaunce," with some charming photographs, in *The Lady's Realm* for November, 1896.

NOTES ON THE MOLLUSCA (POST-PLIOCENE AND RECENT) OF FELSTEAD, ESSEX.

By A. S. KENNARD and B. B. WOODWARD, F.L.S., F.G.S.

THROUGH the kindness of Mr. J. French, who forwarded the whole of his specimens for examination, it is now possible to furnish a list of both the Fossil and Recent Mollusca from this locality (*see ante* p. 93); but since, unfortunately, no record had been kept of the beds from which the former came, there is still much to be added to our knowledge of the deposits. Mr. French's list (ESSEX NATURALIST, vol. iii., pp. 12-13) contained forty-two species as occurring in a fossil state, but we have only been able to identify thirty-two species, viz. :—[1]

Vitrea crystallina
,, *nitidula*
,, *pura*
,, *radiatula*
,, *nitida*
,, *fulva*
Pyramidula rotundata

Vallonia pulchella
Pupa anglica
,, *cylindracea*
Vertigo antivertigo
,, *substriata*
,, *pusilla*
,, *angustior*

---

[1] The names are those of the list of British Non-Marine Mollusca inserted at p. 108 of the present volume of the ESSEX NATURALIST.—ED.

Hygromia rufescens
,, *hispida*
Helicella caperata
,, *itala*
,, *carthusiana*
Helicigona lapicida
,, *arbustorum*
Acanthinula aculeata
,, *lamellata*
Clausilia rolphii
Succinea putris
,, *elegans*
Carychium minimum
Limnæa truncatula
Pomatias elegans
Acicula lineata
Pisidium fontinale
,, *pusillum*.

Since there are no specimens forthcoming, the following thirteen species must for the present be rejected :—

Vitrea cellaria
Hygromia granulata
Helicella cantiana
Helix aspersa
,, *hortensis*
,, *nemoralis*
Pupa muscorum
Vertigo pygmæa
Clausilia bidentata
Cochlicopa lubrica
Azeca tridens
Cæcilianella acicula
Balea perversa.

There are only three new records :—*Vitrea nitida*, *Vertigo pusilla* and *Vertigo angustior*.

The most important species is, of course, *Helicella carthusiana*. Its range at the present time in this country is Kent and Sussex, and in the former county it does not occur north of the river Stour. That it formerly had a much larger area of distribution is proved by this occurrence, and by the fact that it has also been recorded from a Holocene deposit at Butley, near Orford, Suffolk. In all probability, the deposit [? Felstead, Ed.] is of of the same age as those at Chignal St. James, Roxwell and Shalford.

RECENT SPECIES.

The species living in the district at the present time which have been identified from Mr. French's specimens are sixty in number :—

Vitrea crystallina
,, *alliaria*
,, *glabra*
,, *nitidula*
,, *pura*
,, *radiatula*
,, *cellaria*
Cæcilianella acicula
Cochlicopa lubrica
Succinea putris
,, *elegans*
Carychium minimum
Physa hypnorum
Limnæa stagnalis

Vitrea nitida
Punctum pygmæum
Sphyradium edentulum
Pyramidula rotundata
Hygromia rufescens
,, *granulata*
,, *hispida*
Helicella caperata
,, *virgata*
,, *itala*
,, *cantiana*
Helicigona lapicida
,, *arbustorum*
Helix aspersa
,, *hortensis*
,, *nemoralis*
Vallonia pulchella
Buliminus obscurus
Pupa cylindracea
,, *muscorum*
Vertigo pygmæa
Clausilia bidentata
,, *laminata*
Limnæa palustris
,, *pereger*
,, *auricularia*
,, *truncatula*
Ancylus fluviatilis
Bythinia tentaculata
Valvata piscinalis
,, *cristata*
Unio pictorum
,, *tumidus*
Anodonta cygnæa
Sphærium corneum
Pisidium amnicum
,, *fontinale*
,, *pusillum*
,, *nitidum*
Planorbis fontanus
,, *albus*
,, *spirobis*
,, *vortex*
,, *carinatus*
,, *marginatus*
,, *contortus.*

We would take this opportunity of thanking Mr. French for thus placing his specimens at our service, and we trust that his labours in the natural history of his own district may be imitated by many members of the Essex Field Club, and that thus many of the minor problems which confront the naturalist of to-day may be solved.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Red Deer Antlers used as Food.—According to the Moscow correspondent of the *Standard* Oct. 25th, 1897, a small Commission, sent by the Russian Imperial Geographical Society to investigate the condition of the Red Deer in the region of the Altai Mountains, has just returned to St. Petersburg. "The stags are reported by sportsmen to be of unusual size, much exceeding those known in any part of Europe. Shooting expeditions in these regions, however, have failed, at least so far as the Red Deer are concerned, owing to the practice among the natives of killing the stags while the horns are still in the *velvet*. It appears the young horns are exported to China, where they fetch very high prices, being employed to make a kind of soup much esteemed as a fortifier in cases of premature decrepitude and the like. The results of the Commission's investigations are not yet known, but it is to be hoped, our Correspondent says, that a stop will be put to such a ruinously wasteful and unsportsmanlike traffic before these magnificent animals are quite exterminated." [It has long been a tradition with foresters that deer themselves eat the cast antlers, which are so rarely found, a belief which is now shared by many naturalists, bearing in mind the prodigious amount of calcareous matter which must be needed to supply bone material for the annual renovation of the antlers, we can understand the benefit that the animals may derive from their diet of bone.—Ed.]

AVES.

Capture of an Albatross at Linton on the Essex Border.—The Rev. J. G. Tuck, of Tostock Rectory, East Suffolk, writes in the *Zoologist* (i. 4th ser. 365), that on or about July 1st, 1897, a bird of the Albatross family was sent to Mr. Travis, of Bury St. Edmund's, for preservation. It had been caught at Linton, Cambridgeshire, on the borders of Essex. The bird in colour much resembles a Great Black-backed Gull, and measured in the flesh perhaps 34 or 36 inches, with an expanse of wing of probably seven feet. Mr. Tuck adds, "so far as I am aware, only one Albatross of any species has ever reached England alive, and this lived for a short time in the Zoological Gardens some twelve or fourteen years ago; but the beautifully clean plumage of the Cambridgeshire bird quite precludes the possibility of its ever having been in confinement." The specimen has since been submitted to Mr. Howard Saunders and Mr. O. Salvin, and pronounced by these experts to be *Diomedea melanophrys*, the species "which haunted the Færoes for 30 years, and which has also been taken high in the N. Atlantic."

Bird Slaughter. In the *Times*, October 20, 1897, a correspondent "Edward Clifford," asks if it is possible to avert the speedy extinction of small birds in Italy; thousands of siskins and chaffinches, and hundreds of robins, linnets, tomtits, thrushes, goldfinches and larks being at this time of the year sold for the table in Italy, which during the warmer months have been living in England and other northern countries. On another page of the same paper, Mr. C. J. Cornish, the well-known naturalist, mentions the fact that a pelican, supposed to be the one lately in Kew Gardens, which has recently been seen on the Thames at Corney Reach and on the reservoirs of the Middlesex Waterworks, has been shot by some British barbarians. T. V. HOLMES.

PISCES.

Ocynus thynnus (Short-finned Tunny) at Foulness.—Mr. H. L. Matthams recorded in the *County Chronicle* that a big fish came ashore at Foulness about the 26th of October. "It was 9ft. long, and as big round as a horse. It weighed five or six cwt. It was covered with fine and very hard scales. The flesh was red and very firm." Dr. Laver (to whom we sent the cutting) is of opinion that this big fish was a short-finned tunny (*Ocynus thynnus*) a very rare visitor to our shores. In reply to questions from Dr. Laver, Mr. Matthams says that the pectoral fin was about a foot in length. "The fish was so big that a fair-sized man sitting on it could not touch the ground with his feet." The tail was about 2ft. across from point to point. The stomach was quite empty, the flesh in good condition, and several of the country people cooked some of it. Mr. Matthams adds, "We have never had one here before that we could be sure about, but about 40 years ago a large fish came ashore here; I did not see it, but made out enough to know that it was neither a shark nor a black fish."

INSECTA.

HYMENOPTERA.

Sirex juvencus at Brentwood.—I have to record the occurrence of *Sirex juvencus* in the County, a good specimen having been brought to me by Mr. Francis Thorne of this town, who captured it in his drawing-room.—W. M. W., Brentwood. [The two British specimens of the Hymenopterous genus *Sirex* (*gigas* and *juvencus*) are natives of pine woods, but are occasionally found in towns, like various timber-loving beetles, having been brought. while in the larval or pupal stages, in the interior of wood intended as timer or for firing. *S. gigas* is not very rare near London, but *S. juvencus* is rarely observed.—Ed.]

LEPIDOPTERA.

Chærocampa elpenor at Kelvedon.—On July 30th, three fine specimens of the Caterpillar of the Elephant Hawk-moth (*Chærocampa elpenor*) were put into my hands; they were found by Miss Eunice Watts, on the banks of the River Blackwater at Kelvedon; their food-plant being Goose-grass (*Galium aperine*).—W. M. W. [Presuming no error of observation has occurred, the food-plant is new for this species. We have frequently found the larvæ in Essex on other species of *Galium*, viz., *G. mollugo*, *G. palustre*, *G. verum*, *&c.* but never on the goose-grass.—Ed.]

MOLLUSCA.

"The Non-Marine Molluscs of Essex."—Corrections and Additions.—In my paper on this subject in the last two numbers of the Essex Naturalist, I regret to say that I forgot to note under *Paludestrina jenkinsi* (*ante*, p. 73) that the first British examples were found in Essex, and presented to the British Museum, in the early part of 1889, by Mr. Walter Crouch, F.Z.S. Mr. Crouch collected them in the ditches in the Becton Marshes, Barking, and he later exhibited a series at the Meeting of the Essex Field Club at Theydon Bois, on May 17th, 1890 (*vide* E.N., vol. iv, p. 128), Wilfred Mark Webb, Brentwood. [It should be also noted that Mr. Crouch's Becontree Hundred Collection of Non-Marine Mollusca in the Epping Forest Museum, contains *Dreissensia polymorpha*, Pallas. from the River Lea, a species unrecorded for Essex by Mr. Webb; and also *Hygromia rufescens*, Pennant, from Barking Side.—Ed.

"The Post-Pliocene Non-Marine Mollusca of Essex."—Errata—In Messrs. Kennard and Woodward's paper in the last part, the following errors should be noted:—On page 92, line 18 from top, *for* "Geographical" *read* Geological; on same page, line 10 from bottom, *for* "Crown" *read* Brown. In the inserted Table of species, *Dreissensia polymorpha* should have a "+" affixed to it, as the shell occurs in the Lea River—see note in present part. This addition will, of course, affect the totals given in the table.—Ed.

BOTANY.

Two Rare Essex Plants.—*Peucedanum officinale*, Linn (Hog's Fennel" or "Sulphur-weed.") This very rare plant which has been noticed only in certain stations in the marshes of Essex and Kent, and in the Channel Islands, is recorded in Gibson's *Flora oj Essex* as growing in a field near the Tower-lane, Walton-on-the-Naze, and by the Blackwater near Beaumont. But I never succeeded in finding it until the summer of 1896, when Mr. R. S. Standen told me that he had noticed it as fairly plentiful at Thorpe-le-Soken. *Frankenia lævis*, Linn. ("Smooth Sea-Heath.") I had frequently searched for this rare plant in the stations given by Gibson, but without success. This summer I visited the locality at Walton-on-Naze with Mr. Standen, and we were fortunate enough to find the plant. Later in the year Miss Lily Grant-Duff found several fine patches growing in a new locality between Clacton and Brightlingsea.

The above finds are worth recording, I think, because it is satisfactory to know that these Essex rarities are still well established, and also because the fact that in each case they were observed at places several miles from the localities previously known, would seem to show that they are probably more widely distributed than was suspected previously. In fact my experience leads me to believe that rare plants are, as a rule, spread over a wider area than published records would seem to indicate, and that a search through the districts in the neighbourhood of the known stations, would often prove this to be the case. J. C. SHENSTONE, Colchester.

CRYPTOGAMIA.

Essex Characeæ.—The records of stations for Characeæ in Essex are so few in number, that the following may be of interest;—In an old pond on Doddinghurst Farm, about four miles from the railway station, Brentwood, in September, 1894, I found growing in abundance *Chara fragilis*, Desv.; *Chara vulgaris*, Linn.; and *Nitella opaca*, Ag. These plants were kindly identified for me by Mr. Arthur Bennett, F.L.S. In 1891 I noticed a few plants of *Chara fœtida*, A. Br. [? a form of *C. vulgaris*, L., ED.] growing in a ditch on Mr. Billups' farm, at Canning Town. This locality has since been built over. WILLIAM ALLEN, 10, Barking Road, Canning Town.

Cynophallus caninus, Fr., in Epping Forest.—At a Fungus Hunt carried on by a small party of the Toynbee Natural History Society on Saturday October 2nd, one of the Members found a specimen of *Cynophallus caninus*, Fr., in Bury Wood. It belongs to the Phalloidei, and is allied to the "Stink-horn" (*Phallus impudicus*) but is without its unpleasant odour. I communicated with Mr. George Massee, F.L.S., of Kew, and in his reply he says "the pretty little *Cynophallus* is not common anywhere, and every authenticated locality ought to be recorded." Would you therefore kindly note this gathering in the ESSEX NATURALIST?—ROBERT PAULSON, *Hon. Sec. T.N.H.S.* [Several specimens of the *Cynophallus* were found by Mr. E. M. Holmes, F.L.S., at our Fungus Meeting on November 21st, 1896, in the Forest near Hale End, and on two other occasions it has been found, but it is certainly very rare with us. See ESSEX NAT., vol. ix., p. 250. ED.]

Newspaper Science—Poisonous and Edible Fungi.—Prof. Boulger writes, "The following gem is perhaps worth reproduction. I think it was in the *Daily Chronicle*":—Our Paris Correspondent writes:—"An exhibition of poisonous and edible fungi will be held on Sunday, at the Hall of the Horticultural Society, 84, Rue de Grenelle. Some useful knowledge is to be obtained in looking at the exhibits. The toadstool mushroom is no longer treated here as a fungus. One sees it sold at the grocer's at high prices under the name of 'Cepes de Bordeaux.' The toadstool, which becomes the colour of indigo when broken, is also used for culinary purposes."

METEOROLOGY.

Whirlwind near Halstead on June 30th.—As Mr. G. J. Symons, F.R.S., remarks in his *Monthly Meteorological Magazine*, "truly Essex is a wonderful county! Mr. Joseph Last, haybinder, of Halstead, sent information to the branch office of the *Essex County Chronicle* in that town on Wednesday, June 30th respecting a whirlwind that took place in the hayfield at Nether Priors about noon. The writer stated that a large quantity of hay was taken up into the air and carried out of sight. Twelve men who were at work in the field watched the travelling of the hay in great amazement." The hay appears to have fallen about three miles further north on the same day about eleven o'clock. [There is a discrepancy of time here, between the two records, or there may have been more than one whirlwind.—Ed.] A curious phenomenon was witnessed in the neighbourhood of Belchamp St. Paul, N. Essex. "For some minutes the atmosphere was laden with falling hay, which came down in a very fantastic manner, some quite large bunches being among the single bents. It is supposed to be the effect of a whirlwind on a distant hayfield."

"The Great Storm of Midsummer Day, 1897."—The Photo-block Map accompanying this paper (*ante* p. 114) did not print off so clearly as was intended. Readers are advised to darken the dots showing damage by hail with Indian Ink. Ed.

MISCELLANEA

"Four Days in a Denehole; an old Man's Terrible Experience."—We take the following under the above title from the *Daily Mail* of September 21st, 1897:—"An elderly inhabitant of the village of Crockenhill, Kent, named Richard Castleton, was on Thursday afternoon rescued from a denehole, of which there are many in that part of Kent, after having been incarcerated four days. He had been missing since the previous Sunday afternoon, when he entered a wood in search of nuts. His disappearance caused considerable anxiety in the village, and on the fourth day it occurred to a man named Chambers that Castleton might have fallen into the denehole, and a search party was instituted, a dog accompanying them. Upon arriving at the mouth of the hole the dog became very excited, and it jumped down. Ropes were lowered, and the man was eventually brought to the surface, apparently more dead than alive, having only had a few nuts to eat all the four days of his imprisonment. He states that on being precipitated into the hole, which is from 40ft. to 50ft. deep, he lay at the bottom for some time in a semi-unconscious state, having sustained slight concussion during the fall. As he lay on a bed of mud, and through the small opening at the top sunlight and darkness succeeded each other without any help coming in response to his calls, he suffered, he states, terrible mental anguish."

Mr. T. V. Holmes informs us that on September 23rd he passed through the village, and ascertained that the facts had been accurately reported. Crockenhill is a village on the Thanet Sand, about a mile S.W. of Swanley Junction on the London, Chatham and Dover Railway, and about three miles S. of the Deneholes of Joyden's Wood, Bexley. The above incident recalls the mysterious tragedy of which Denehole No. 3 in Hangman's Wood was the scene in years long past. Readers of the Report of the Exploration of the Deneholes will remember the fact that in removing the cone of gravel and Thanet-sand from the bottom of the shaft, the explorers came upon the bones of a man and horse, with portions of decayed leather probably representing a bridle (see Report in E.N., vol. i., p. 238). The conclusion was drawn that they were the remains of a mounted traveller through the Wood who had met death, perhaps a century before, by falling down the shaft and so miserably perishing—or they were possibly the partial evidence of a yet deeper tragedy—who shall say! On the occasion of our last visit to the Deneholes on August 12th, 1893, Mr. W. Cole found in No. 2 Pit a poor dog, living, but in almost the last stages of starvation, which was rescued and tended (see E.N., vol. vii., p. 147). It may be added that the *Daily Mail* on October 4th, incited by the tale of the Crockenhill mishap, gave a very good short account (illustrated) of the Deneholes, under the title "What is a Denehole? The Puzzle of the Age."—They are truly still a puzzle; when shall it be solved?—ED.

The late Sir B. W W. Richardson on the Educational Value of Local Museums.—The late Sir Benjamin Ward Richardson, F.R.S., became a surgeon's assistant first at Saffron Walden. This is how he speaks of the Museum there in his auto-biographical *Vita Medica* (Longman's 1897) "There was an institution devoted to natural specimens. Who started it I cannot say, but the late Dr. Forbes Winslow and the late Dr. Edwin Lankester, who had been assistants in the town before me, had assisted in sustaining it and their efforts stimulated me to do the same. The determination did me a great deal of good and made me curious. At the village of Duddenhoe End near by, a boy by the name of Wombwell was born, and became devoted to natural pursuits. He collected animals of all kinds, showed them about, and in the end became well-known as the owner of the finest travelling menagerie in the kingdom. We were very grateful to Wombwell, as I have often told his mother, who was a patient of mine, for in order to serve us he sent many animals after they were dead, to the museum. He sent lions, leopards, tigers, bears, and many sorts of birds, some of which were dissected, their skeletons being set up and their skins stuffed and preserved. I had the opportunity of learning a vast deal from this museum; the leading points of difference between the herbivora and the carnivora, including observations that have lasted me as subjects of study up to this time, and have always been useful at my lectures." [Extracted and sent in by Prof. BOULGER, F.L.S.]

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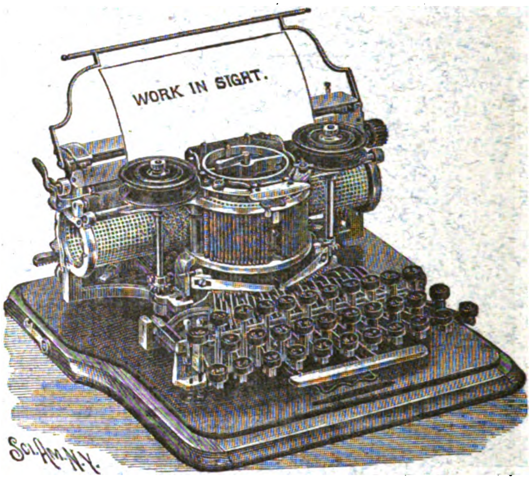
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A CONTRIBUTION TO

The Natural History of the County.

(Forming Volume iii. *of the "Special Memoirs" of the Essex Field Club).*

BY

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WITH EIGHT FULL-PAGE AND TWO HALF-PAGE ILLUSTRATIONS.

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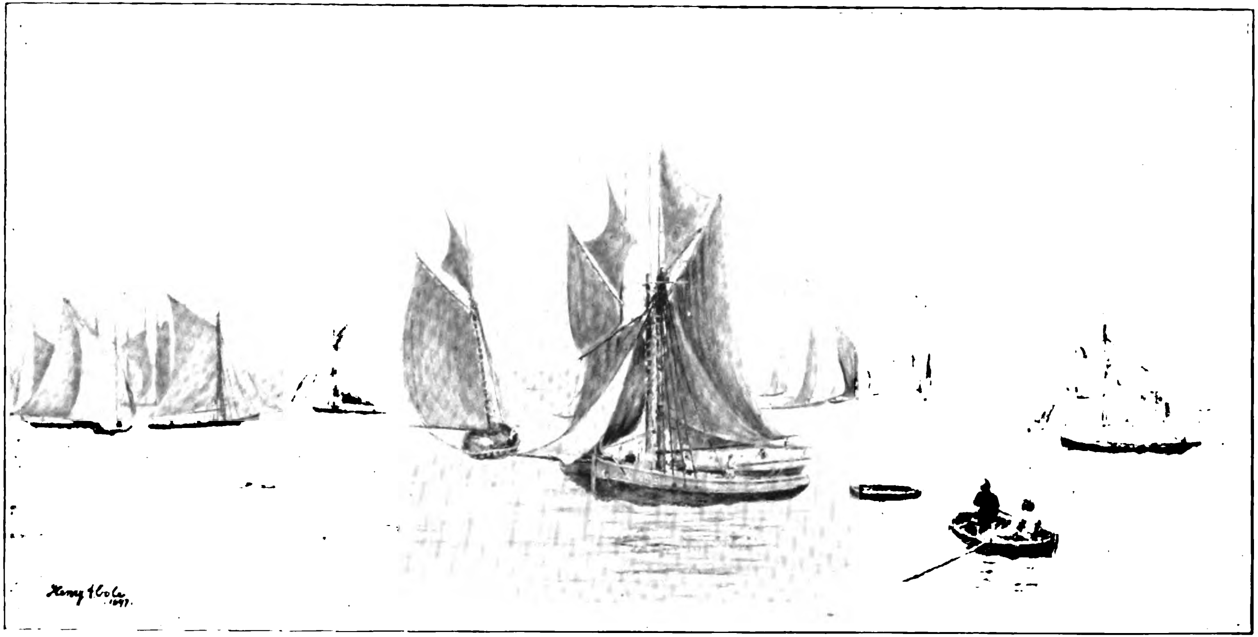

DREDGING UP BROOD OYSTERS IN THE COLNE. MORNING.

(From a Painting by H. A. COLE).

"Hey! for the Dredge, with its iron edge,
And its mystical triangle,
And its hided net, with meshes set,
Odd fishes to entangle."

THE ENTOMOSTRACA OF EPPING FOREST,
WITH SOME GENERAL REMARKS ON THE GROUP.

By D. J. SCOURFIELD.

[*Read November 27th, 1897.*]

PART I.

SOME GENERAL REMARKS ON ENTOMOSTRACA.[1]

THE little aquatic animals known scientifically as Entomostraca, and popularly as Water-fleas, can certainly claim to constitute, at the present day and in this country, one of the neglected zoölogical groups. Although familiar enough in a general way to the majority of naturalists, it is surprising how little is really known about these extremely interesting creatures, even by those who have devoted considerable attention to the examination of the life of our lakes, ponds, and ditches. A few general remarks on the group may not be out of place, therefore, as an introduction to the subject of the Epping Forest forms, and more especially as this is the first paper of its kind brought before the Essex Field Club. It must be understood, however, that the following remarks do not by any means touch upon all the varied problems connected with the Entomostraca. To do that adequately would require, not part of a paper, but a very large volume, and a very much deeper student of the subject than I can claim to be. Purely morphological matters it will be noticed in particular have been entirely omitted.

Zoölogical Position, Sub-Divisions, &c.

As regards zoölogical position the Entomostraca constitute the lowest of the great divisions of the class Crustacea, and they may consequently be considered as the poor relations of such well-known creatures as the crabs, lobsters, shrimps, sand-hoppers, and wood-lice. The extent of the group and its sub-divisions varies somewhat according to different authorities, but the following arrangement is perhaps the most usual:—

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[1] Part II., containing the "Chief results of work on the Entomostraca of Epping Forest"; Part III., "A detailed list of the Epping Forest species"; and Part IV., "A Bibliography of the Literature relating to the British Fresh-water Entomostraca," will be published in succeeding parts of the ESSEX NATURALIST.—[ED.]

ENTOMOSTRACA	*Order* 1.	Branchiopoda	
	Sub-order.	Phyllopoda	e.g. *Apus*, *Cheirocephalus*
	,,	Cladocera	e.g. *Sida*, *Daphnia*. (Common Water-fleas)
	,,	Branchiura	e.g. *Argulus*. (Fish-lice)
	Order 2.	Ostracoda	e.g. *Cypris*, *Candona*.
	Order 3.	Copepoda	e.g. *Cyclops*, *Diaptomus*.
	Order 4.	Cirripedia	e.g. *Lepas*, *Balanus*. (Barnacles)

Although open to criticism, it is occasionally convenient to speak of the three sub-divisions of the Branchiopoda as if they were equal in rank to the three remaining orders, and this will be done in the present paper. Of the six divisions then enumerated above, the Phyllopoda, Cladocera, and Branchiura are almost exclusively inhabitants of fresh-water, the only exceptions being that some Phyllopods live in brackish water and salt lakes, and that a very few Cladocera and Branchiura are marine. The Ostracoda and the Copepoda, on the other hand, are mainly marine animals, although having numerous fresh-water representatives. The Cirripedia are exclusively marine.

With the exception of the Phyllopoda, all the *fresh-water* Entomostraca may be classed as microscopic animals, *i.e.*, animals which require magnification to show even the main characters of their organisation. But the members of the different groups vary very much in respect to size. Thus the Phyllopoda range in length from $1\frac{1}{5}''$ to $\frac{1}{9}''$, the Cladocera from nearly $\frac{1}{2}''$ (*Leptodora hyalina*) to $\frac{1}{110}''$ (*Alonella nana*, said to be the smallest known Arthropod), the Ostracoda from $\frac{1}{6}''$ (*Cypris barbata*) to $\frac{1}{55}''$ (*Cyclocypris lævis*) and the free-living Copepoda from $\frac{1}{5}''$ (*Diaptomus superbus*) to $\frac{1}{70}''$ (some of the smaller Harpacticids). The fresh-water parasitic Copepods may, however, be much larger than $\frac{1}{5}''$, and there exist both larger and smaller marine forms of Ostracoda and Copepoda than those mentioned above.

Number of Known Species.

A point which does not seem to be very generally realised in relation to the Entomostraca is the great variety of different forms included in the group. The prevalent idea appears to be that the number of species of Entomostraca, especially those living in fresh-water, is very limited. Compared with some other animal groups, the Lepidoptera or Diptera for example, this is quite true, but still the total number of recognised species is by no means a small one. Vosseler (106)[2] says that considerably more than 2,000 species have been described. Many of these will no doubt ultimately be found to be mere varieties, but considering the vast areas of the earth's surface that have not yet been properly searched for these animals, the number mentioned is probably smaller than that of the species actually living at the present time. The fresh-water forms hitherto recorded may be estimated at 600, distributed as follows:—Phyllopoda 100, Cladocera 200, Branchiura 20, Ostracoda 120, and Copepoda 160. Of these we have in the British Isles, as far as yet known, only about 190, namely, Phyllopoda 2, Cladocera 75, Branchiura 1, Ostracoda 58, and Copepoda 54.

Distribution and Habitats.

The distribution of the Entomostraca is, like that of so many of the lower groups of animals, world-wide, and this is true not only of the group as a whole and its main divisions, but of the majority of the genera and not a few species. Confining our attention to the fresh-water forms, and from this point onwards reference will only be made to these, we find, for example, that all our British species, with only one or two doubtful exceptions, extend to all parts of the European Continent; further, that most of them have been found in North America and many also in Asia, while some even occur in South America, South Africa, Australia and New Zealand. Notwithstanding the fact of wide distribution, however, and the consequent similarity between the total faunas of different countries over large areas, as for instance over the whole of Europe, it is also true that the faunas of certain districts of limited extent within each country possess characteristic features. This is no doubt mainly due to differences in the types of the lakes, ponds, and other waters of the different parts of a country. The lakes and tarns of a wild mountainous region, to take an extreme example, differ in almost every detail from the lowland ponds and meres, and many of their Entomostracan inhabitants also differ from those found in the latter. But this subject of local distribution is by no means thoroughly understood at present, and requires much further investigation.

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[2] The figures in brackets refer to the numbers of the papers in the Bibliography appended (See Part IV.)

Corresponding to their wide range in space, we also find a very great variety in the habitats of the Entomostraca. Indeed, it may be stated generally, that wherever there is water, there will be found some representatives of the group. It matters not whether the water is in large or small quantities, whether hot or cold, whether clean or dirty. Little temporary pools, and sometimes cart-ruts and hoof-prints, yield their contingent as well as the largest lakes. Even in situations where there is no standing water at all, as in some bogs, damp mossy hollows, and mosses on tree trunks above the water's edge, some species are sure to be found if carefully searched for. But perhaps the most curious natural situation in which Entomostraca have been found is that mentioned by Fritz Müller, who discovered in Brazil a species of ostracod living in the cups formed by the leaves of plants belonging to the Order Bromeliaceæ. The animals appeared to be quite at home, and, what is still more remarkable, they did not resemble any of the species found in the ponds and other waters of the surrounding country.

Habits of the Entomostraca.

The study of the habits of the various species offers a wide field for very useful work, as comparatively little is yet known on this most fascinating subject. The facts hitherto elucidated have been for the most part connected merely with the modes of life exhibited by the different forms. From this point of view the Entomostraca fall pretty naturally into two divisions, swimmers and non-swimmers. The swimmers again may be divided into the constant and the intermittent swimmers. The former, confined to a comparatively small number of species of Cladocera and Copepoda, are best represented by the pelagic, limnetic, or plankton forms, *i.e.*, those which live continuously in the open water of fair-sized ponds or lakes. These forms may support themselves in the water either entirely by virtue of their powerful organs of locomotion *e.g.*, *Diaphanosoma*, *Diaptomus*, *Cyclops strenuus*, &c., or they may possess long spines and other outgrowths increasing their power of remaining suspended without much effort, *e.g.*, *Daphnia cucullata*, *Bosmina*, *Bythotrephes*, &c. The group of the constant swimmers also includes all the species of the genera *Daphnia* and *Ceriodaphnia* not already included among the plankton forms, for although some of these are occasionally to be seen at the bottom, and still more often among plants, they are not bottom forms in a proper sense of the term, nor have they any means of clinging or attaching themselves to the vegetation in the water.

The next section, that of the intermittent swimmers, is a very large one, comprising the majority of all the orders except the Ostracoda. In this group also it is possible to roughly distinguish two sub-groups, the one including species which live habitually at the bottom, and the other, species which prefer to live in and about the miniature forests of water plants. These divisions, although not very rigidly defined from one another, many species living apparently indifferently at the bottom or among weeds, may nevertheless be conveniently referred to separately. The bottom forms have evidently adopted the easiest possible method of avoiding the irksomeness of a continual use of their swimming organs, since it does not require any modification of structure to cease swimming and drop to the bottom. As examples of these animals may be mentioned *Latona*, most of the Lyncodaphnidæ (*Macrothrix*, &c.), *Camptocercus*, *Leydigia*, *Alona quadrangularis* and *affinis*, *Alonella rostrata*, *Pleuroxus uncinatus*, *Harporhynchus* and *Monospilus* among the Cladocera, some few species of Harpacticidæ among the Copepoda, and *Cypria ophthalmica* and *Pionocypris vidua* among the Ostracoda.

The members of the other sub-group, namely, those which live among the water weeds, all possess some means of clinging or attaching themselves to the same. For this purpose representatives of the Copepoda and Ostracoda have not required any special modification, as the structure of the second antennæ and mouth organs in the former Order, and of the second antennæ and feet in the latter, is such that it enables any of these animals to cling to almost any solid object in the water. The principal forms belonging here, are, among the Ostracoda, species of *Cyclocypris*, *Cypris*, and *Notodromas*, and among the Copepoda, *Diaptomus castor*, most species of *Cyclops*, and nearly all the Harpacticidæ. The case is different, however, with the Cladocera; and here we can see that a large amount of modification of quite different organs has taken place for enabling these creatures to support themselves without the effort of continuous swimming. Thus *Sida crystallina* attaches itself to aquatic plants by means of a complex gland at the back of the head and neck, a method probably unique among the Cladocera. I am well aware, however, that several authors state that other species use the "cervical gland" for attachment, but I believe this to be erroneous. In the species of *Simocephalus* the clinging is accomplished by means of an alteration of one of the three terminal setæ of the outer or dorsal branch of each of the swimming antennæ. The tip of this seta, instead of tapering to a simple point, is bent round into an excessively minute hook, and it is by means of this that the animals can suspend themselves. In the genus *Scapholeberis*, and in nearly all the Lynceidæ, the clinging is apparently brought about by the little hooked setæ on the first and second pairs of feet. These animals, therefore, in direct contradistinction to *Sida* and *Simocephalus*, rest with the ventral aspect of their bodies towards the supporting object. Not only can the "clingers" among the intermittent swimmers fix themselves to solid objects, but some of them have also the curious habit of using the surface-film of water for support. The two forms which do this most systematically, and which present special adaptations for the purpose, are *Scapholeberis mucronata* and *Notodromas monacha*, but others, such as *Cyclops fuscus* and *C. prasinus*, may likewise be seen at times clinging to the surface-film (83). To the group of the intermittent swimmers also belong the species of the Branchiura. These are all externally parasitic upon fishes, and, like our *Argulus foliaceus*, attach themselves to their hosts by means of powerful suckers.

Concerning the non-swimming species of Entomostraca not very much need be said. The group consists very largely of Ostracoda belonging to such genera as *Herpetocypris*, *Ilyocypris*, *Candona*, and *Limnicythere*. To these must be added the parasitic Copepods, of which the adult females, at least, seem never to leave their hosts, and a few species of Cladocera all belonging to the genus *Ilyocryptus*. It may be pointed out that the non-swimmers are nearly all bottom-loving animals, though some of the Ostracoda crawl about freely among aquatic vegetation when they get the opportunity.

Many other miscellaneous facts connected with the habits of the Entomostraca could easily be added if this section were not already too long. Nevertheless nothing that has yet been discovered in this branch of study can be considered to have done more than just lift here and there the veil that covers a vast number of facts, some of which, there is good reason to believe, will be found to be either directly or indirectly of importance to our own well-being.

Reproduction and Development.

Although this is evidently not the place to enter into a lengthy account of the reproduction and development of the Entomostraca, a few points may be usefully touched upon, as they furnish the explanation of some of the peculiarities in the records from Epping Forest to be discussed presently. The first of these is that the vast majority, if not all the fresh-water Entomostraca, possess the power of parthenogenetic reproduction. Among the Cladocera and many of the Ostracoda this power is put into operation regularly for a certain period or periods each year. The length of the purely parthenogenetic period varies very considerably in different species, but appears in the main to depend rather upon the individual idiosyncrasy of the species than directly upon external influences (107). It may be confined to the first generation, *i.e.*, the one hatching from the resting eggs, as in *Moina*, or it may run through four or five generations, as in some forms of *Daphnia*, *Chydorus*, &c., or again it may extend to many generations, as in most of the limnetic species of the Cladocera. In some few instances, *Bosmina longirostris* (*?*) and most species of *Cypris*, the parthenogenetic may even be the only method of reproduction. The species of Copepoda and the remainder of the Ostracoda, on the other hand, while still retaining the potentiality of a sexual reproduction, are usually represented at all times by individuals of both sexes.

Another fact to be noticed is that all the Cladocera are capable of producing two kinds of eggs, namely, the ordinary eggs, known usually as "summer-eggs," not needing fertilisation, but fitted only for immediate development under the protection of the mother, and "resting-eggs," or, as they are sometimes termed, "winter-eggs," capable of remaining undeveloped for very long periods, many years in some cases, but requiring fertilisation. The appearance of these two kinds of eggs is very different, and the resting-eggs, moreover, are, in most cases, provided with a special covering formed from the shell of the mother and known in its most highly evolved state as an "ephippium." Females carrying resting-eggs, with or without a true "ephippium," are conveniently called "ephippial females." So far as can be judged by their appearance, the Ostracoda and Copepoda only produce eggs of a single type. In these cases the eggs seem to be intended for immediate development, but there can be no doubt that many also possess some power of remaining dormant. Much more light is wanted, however, on this subject.

Yet another point may be briefly referred to, as it is a very important one to the collector. The eggs of the animals belonging to the different sub-divisions of the Entomostraca hatch out in very different ways. Thus the egg of a Copepod develops into a typical "*nauplius*," *i.e.*, a little free-swimming unsegmented ovoid larva with only three pairs of appendages. After several preliminary moults, at each of which new appendages make their appearance, the larva suddenly (at a moult of course) takes on the typical Copepod form. By a number of further moults, each accompanied by the development of new appendages (except in the parasitic forms, where various retrogressive changes take place), the adult stage is finally reached. The Phyllopoda also hatch as *nauplii*, but these possess behind the three main pairs of appendages a series of little paired lobes, foreshadowing the future foliaceous feet. The Ostracoda are provided at birth with a bivalve shell in the same way as the adults, but the little animal within is in other respects a *nauplius*. The Branchiura hatch out in a more advanced stage than either of the foregoing groups, but the young is still a larva differing from the adult in many important particulars, but especially by the absence of the large suckers. In the remaining group, the Cladocera, the young, with only one exception, leave the egg in all essential particulars similar to the adult. They require, however, to moult many times before assuming the characteristic outlines of the species. The exception referred to is in the case of the young hatched from the resting-eggs, and from these only, of *Leptodora hyalina*. These are in the form of a Phyllopod *nauplius*. From the foregoing facts it will be seen that the task of determining all the forms of Entomostraca that one finds is not altogether an easy matter. The only safe rule for beginners is never to attempt to name a form that does not show very good evidence of being adult.

Food.

Considered as a whole, the Entomostraca appear to be decidedly carnivorous in their tastes. But, except among the parasitic forms, vegetable food is probably in no case altogether despised, and may sometimes even form the sole nourishment of certain species. Thus some pelagic forms of *Cyclops* have been found living wholly on Diatoms (91), and Prof. S. A. Forbes (93) mentions a case in which an American *Diaptomus* (*D. shoshone*) was found to be feeding exclusively upon the pollen grains of the pine which had blown into the water from the neighbouring forests.

Owing to the very different morphological characters of the mouth organs, the particular form in which food is taken varies considerably. But most of the methods of feeding belong to one or the other of three main types. The Ostracoda, and also most of the Copepoda, are furnished with more or less powerful appendages for seizing and tearing their food, and act in consequence as veritable scavengers, by rapidly breaking up and assimilating all kinds of decomposing animal and vegetable matter. The Cladocera, on the other hand, have no means, except in a few cases (*e.g.*, *Bythotrephes*, *Leptodora*, &c.), of disintegrating large food-masses, but depend entirely upon minute particles suspended in the water. These may consist of living organisms such as Unicellular-Algæ (Desmids, Diatoms, &c.) and Protozoa (Rhizopods and Infusoria), or of tiny fragments of the larger animals and plants which have undergone decay. The third type of feeding, by the imbibition of the juices of other animals, chiefly of fishes, occurs only in the parasitic forms, namely, the Branchiura and some Copepoda.

In connection with this subject of the food of the Entomostraca, it may be pointed out that the careful compilation of statistics in regard to the different species would throw a flood of light upon the interesting problem of the inter-relations of the animals and plants found in our inland waters.

Economic Importance.

It will be clearly seen from the foregoing paragraph, taken in conjunction with the fact that the Entomostraca occur in enormous numbers, that we have to thank these little animals for disposing of a very large amount of decomposing organic matter which might otherwise become very unpleasant and even injurious to health. But these creatures have a further value for human beings, in that they form directly, or indirectly, a large proportion of the food of fishes. In this district, to be sure, the value of fresh-water fishes as food is not very high, but in other localities, and still more in other countries, especially Germany, fresh-water fishes are systematically reared in large quantities, and by adopting the methods used abroad it would not be impossible for us, even in this neighbourhood, to greatly increase the importance of our fresh-water fisheries. Now these methods of fish-culture depend very largely upon a knowledge of the value of Entomostraca as food for fishes. It has been proved over and over again that many fishes, even in the adult state, feed almost exclusively upon Entomostraca, while it seems certain that the fry of nearly all species are directly dependent upon these little crustaceans for the bulk of their nourishment.

It is always useful to illustrate one's statements if possible by examples taken close at hand, and that must be my excuse for giving here the results obtained by examining the contents of the stomachs and intestines of a few little fishes caught in the Forest area.

Three specimens of the Three-spined Stickleback (*Gasterosteus aculeatus*) gave the following results. The first, taken in Higham Park in August, 1893, had been feeding almost exclusively on Entomostraca, of which no less than 70 individuals were counted. The majority of these were *Cyclops viridis* (*brevicornis*), but there were also representatives of nine other genera, none of which, it may be remarked, were essentially bottom forms. The only other food noticed consisted of a few statoblasts of *Plumatella* and some fragments of Algæ. The second, from a ditch running into Connaught Water, also taken in August, 1893, had in its stomach about a couple of dozen Entomostraca (all *Chydorus sphæricus*) and a very good assortment of other interesting objects, *e.g.*, 1 Rotifer, 3 Rhizopods, a few insect larvæ, parts of an Asellus, numerous Desmids and Diatoms, &c. The third, caught in a little pond near Snaresbrook, in January, 1894, unlike the first, had been specialising on mud-loving Entomostraca, for its stomach contained such species as *Ilyocryptus sordidus*, *Leydigia quadrangularis*, *Alona quadrangularis*, *Canthocamptus staphylinus*, &c. In all about 65 Entomostraca were counted, and there were also remains of Insect larvæ (? *Chironomus*), Nematodes, Diatoms, Desmids, and pieces of Algæ.

Three specimens of Roach (*Leuciscus rutilus*), all from the Eagle Pond, Snaresbrook, yielded the following results. The first, taken in July, 1896, had its stomach and intestines filled largely with enormous numbers of *Bosmina cornuta.* There were also a good many specimens of a *Daphnia* (? *D. cucullata*) and a few each of *Alona quadrangularis*, *Camptocercus rectirostris*, *Chydorus sphæricus*, &c. In addition to these Entomostraca there were some masses of an animal tissue which I could not determine (of some mollusc perhaps), and a few other odds and ends, such as a Rotifer, a Water-mite larva, an Insect larva, a few pieces of fresh-water sponge, &c. The second, taken at the same time as the first, did not yield many Entomostraca, but among the few present were the remains of a species (*Monospilus tenuirostris*) that had never before been obtained in the Forest district. The third, obtained last October, yielded numerous individuals of about twelve species of Entomostraca, some pelagic and some bottom forms. In addition to these there were a great many adult Water-mites (*Atax crassipes*) in its stomach, and, as usual, various other miscellaneous objects.

The above notes, although very meagre, are enough to show that some at least of our fishes do feed directly upon Entomostraca. Moreover it must be borne in mind when considering this subject that the latter not only serve directly as food, but that they also serve indirectly, as they are eaten by other animal forms, *e.g.*, Water-mites, Insect larvæ, &c., which in their turn become the prey of various species of fishes. The whole subject of the direct and indirect relationship of the Entomostraca to fishes is a very interesting one, and notwithstanding the great amount of work already accomplished in this connection, it is still one upon which further research is urgently required.

It may not be out of place to note here that it is quite within the bounds of possibility that the fresh-water Entomostraca will some day be used directly as food by man himself. The marine forms have already been eaten repeatedly (the latest note on the subject is by Prof. Herdman in *Nature*, 14th Oct., 1897, p. 565), and there seems no reason to think that the fresh-water species would be less serviceable in this respect than their relatives in the sea. No one who has collected Entomostraca in some of the more prolific of our larger lakes and seen the layer of oil which forms on the surface of the water containing concentrated gatherings, will have any doubt as to the sufficient abundance of the fresh-water Entomostraca to serve as human food or of their nutritiousness.

Enemies, Parasites, and Diseases.

Some of the most important enemies of the Entomostraca have been mentioned incidentally in the previous section. The subject is, however, worth a little further consideration. Of the invertebrate animals which prey directly upon them may be mentioned the well-known fresh-water polypes (*Hydra*), some aquatic worms (*Nais*, &c.), the Water-mites (nearly all species), a few Rotifers (*Asplanchna*, &c.), and aquatic Insect larvæ of all kinds. One of the latter, a species of *Chironomus*, I believe, constructs a rough kind of snare which may often be seen covered with great numbers of *Daphnia*, &c., looking like so many flies in a spider's web. The fresh-water shrimp (*Gammarus*) and the water wood-louse (*Asellus*), together with some aquatic beetles and various other invertebrates, have also from time to time been reported as feeding upon Entomostraca. Their vertebrate enemies are chiefly fishes, but frogs and newts, both in the larval and adult stages, have been found feeding to some extent upon them. Ducks and other water-loving birds also destroy a certain number, but the extent of their ravages is unknown.

But Entomostraca are not only exposed to the attacks of animals, they have also to be careful of certain innocent-looking plants called Bladderworts (*Utricularia*). Luckily for our Epping Forest species these plants do not grow commonly in the district, but it has been shown (71) that, in places where they thrive, they destroy a very great number of Entomostraca by imprisoning the latter in their bladders and finally digesting them.

The parasites of the Entomostraca include both Ecto-parasites and Endo-parasites. To the former belong some Rotifers (*Brachionus rubens*, *Proales daphnicola*), which attach themselves more especially to species of *Daphnia*, and many Infusoria (*Colacium*, *Epistylis*, *Cothurnia*, *Podophrya*, &c.), some of which are to be found occasionally on nearly every species. In addition to these animal parasites there are also various kinds of Algæ, and a number of very curious organisms, probably Fungi (*Amœbidium*, &c.), but having affinities with the Algæ, which are now and then to be found attached to various species. The internal parasites, which, on the whole, do not seem to be very common among the Entomostraca, include various kinds of Protozoa, more particularly Gregarina, Cysticerci of numerous kinds of tape-worms (62), larvæ of Trematodes, and a fair number of Nematodes. Among the latter are *Cucullanus elegans*, which is known to live at first encysted in *Cyclops*, and then to be directly transferred to the Perch, in which it matures, and *Dracunculus* (*Filaria*) *medinensis* which, in tropical countries, is also found in the larval state in *Cyclops*, and in the adult state in man, although the exact mode of its transference has not been made out.

Of diseases, as distinguished from endo-parasitism of the kind just alluded to, numerous cases have been reported, but they mostly belong to one or other of two main types. In the first a comparatively large fungus of the *Saprolegnia* group gains access to the body-cavity and spreads its colourless filaments in all directions, eventually filling up nearly every available crevice. The other type of disease is produced by the enormous multiplication in the blood of extremely minute granules of various shapes, most of which are known by the rather vague term of *Microsporidia*. These are sometimes coloured, and it is no uncommon thing to take specimens, especially of *Simocephalus vetulus* and *Chydorus sphæricus* which are quite red from this cause.

Methods of Collecting, Examining, and Preserving.

The methods used for collecting the majority of the Entomostraca do not differ essentially from those employed for other forms of pond-life. A wide-mouthed bottle tied to a walking stick, dipped into the water in an inverted position, and then suddenly turned over, will secure a limited number of specimens from almost every desired position. A much better piece of apparatus is, however, a small conical net (say 6" diameter) to the bottom of which a glass collecting tube or small bottle has been affixed. The net may be made of almost any fine-meshed material, but the best and most durable is undoubtedly the silk gauze prepared for sifting flour and known as centrifugal or millers' silk gauze. This is made in various degrees of fineness, but I find that, for Entomostraca, No. 9, with about 100 threads to the inch, is quite fine enough. Such a net, attached to a stick, can be swept through the clear water, worked about amongst weeds, or dragged over the bottom as desired, and the captured animals, washed down into the glass tube, can then be roughly examined with the naked eye or a pocket lens.

In addition to the above, it is often desirable to have a net attached to a line so that it can be thrown out as far as possible.

In this case it is useful to replace the glass tube at the end of the net by a small cylindrical tin weighted with lead. By means of this it is sometimes possible to obtain species not to be taken quite close inshore. If the net is to be used in places where there is much vegetation, the mouth may be covered with a cone (point upwards) of wire gauze of fairly open mesh as suggested by Prof. Birge. This will prevent the net from being choked with weeds and will also keep out the larger animals such as pond-snails, insect larvæ, &c.

For the proper investigation of a piece of water of fair size it is usually necessary to make at least three separate collections with the nets, namely, one from the middle, one from amongst the vegetation near the margin, and one from the bottom. If the collector also makes it a rule to take wet mosses from all situations, but especially such as grow on tree trunks or posts, just above the water level, he will probably not miss very many of the Entomostraca in this district. In other localities, where large and deep lakes occur, it is quite essential to a proper understanding of the fauna to collect from a boat by means of tow-net and dredge, but even in those districts much may be done with the simple collecting appliances previously mentioned. Of course, for quantitative work in any district, a specially constructed net with carefully graduated line, or its recently introduced equivalent, the Plankton-pump, is necessary, but these need not trouble us here.

The golden rule for the examination of the Entomostraca is that it should be made while the animals are alive. No doubt it sometimes happens that this is impracticable, and in such cases it is usually better to preserve a collection for future examination than not to look at the animals at all. But this method should be the exception, not the rule. Work done upon living specimens is not only more pleasant and infinitely more suggestive, it is really easier than with preserved material, for the tissues are more transparent as a rule, and the animals can be manipulated so as to show almost any detail of structure with a minimum of trouble. With a living Copepod, for instance, be it the smallest *Cyclops* or *Canthocamptus*, it is always possible to make out in a very short time all the points necessary for specific determination, without injuring the animal in any way. With preserved examples, however, this is not so easily accomplished, and it is held by some workers that nothing short of dissection then suffices for the purpose.

As soon as possible after capture the various collections made with the nets should be emptied into larger receptacles, with additional water. The common glass jam jars are very useful for this purpose. It is also advisable to pour some collections, especially those made from amongst dense vegetation and from the bottom, into shallow porcelain dishes. Many forms become noticeable in this way which might otherwise be passed over. In either case the collections should be carefully examined with a pocket lens for any specimens having an unfamiliar form or method of progression. In dealing with bottom collections which are very muddy, as is most frequently the case in fact, it is a good plan to wash away the finer particles by placing some of the mud in a little sieve of silk gauze, through which a gentle stream of clean water is allowed to pass. This procedure often brings to light species whose presence was previously quite unsuspected. Wet mosses can be washed in the same way in the sieve, but I usually put them into a jar with water, and, after beating them up vigorously with a fork or some such implement, take out most of the pieces of moss and await results. In a short time a number of Harpacticids, usually *Canthocamptus pygmæus*, are almost sure to be seen swimming about, and very often also species of *Cyclops*, such as *C. bisetosus*, and perhaps also some Alonas, *A. tenuicaudis* for example. This method of washing damp mosses has given nearly all the Epping Forest records of *Canthocamptus pygmæus* and *C. minutus* (Claus), and has yielded two species not found in any other way, namely, *Alona rustica* and *Moraria anderson-smithi*.

As regards the actual examination of Entomostraca under the microscope it is evidently necessary, if we are to deal at all with the living animals, to have some method of preventing them moving out of the field, and it is also essential, in order to see some of the characters made use of at the present day in the determination of species, to be able to use pretty high magnifying powers and a wide-angled sub-stage condenser. These conditions are best fulfilled in my opinion by a slightly modified form of Rousselet's Live-box, and this is the object-carrier I always use. The modification alluded to is simply that, in the place of the large upper circle of comparatively thick cover-glass, which in the original form extends completely across the box, there is inserted a very thin annular metal plate, on the under side and over the central opening of which, the thinnest cover-glass obtainable can be cemented. Personally I prefer a live-box to a compressorium, because with the former it is possible with a little practice to so manipulate the lid that an animal can be turned or rolled into almost any desired position.

The best means of preserving collected material and selected specimens is still somewhat of an open question. Numerous liquids and solutions have been tried with varying degrees of success or the reverse, but there are only two which, by reason of their simplicity in application and inexpensiveness, need be mentioned here. Some of the most experienced workers consider that, in spite of its many shortcomings, such as its rapidity of evaporation and the darkening and contraction which it produces, alcohol in some form is still the best all-round preserving medium. If mixed with a little glycerine the chances of complete evaporation may be very much reduced, and some further slight advantages obtained. Next to spirit may certainly be placed the comparatively recent introduction, Formalin (solution of Formaldehyde). This is especially useful in cases where it is desired to preserve something of the original transparency of the animals. It is also very valuable on account of its efficacy in extremely weak solutions, a few drops at the ordinary strength as sold (40%) being sufficient, for a time at least, for the preservation of quite large collections. The mounting of Entomostraca on glass slips as permanent microscopic objects, although it can be pretty satisfactorily accomplished in glycerine jelly and similar media, has very little to recommend it to the busy student. The method of putting selected specimens into spirit or 5% formalin in little corked tubes (1½" × ⅝" are large enough in most cases) is not only much simpler, but also allows of the animals being examined in any desired position. Necessarily for this purpose the latter have to be picked out with a fine pipette and placed in a live-box or similar object-carrier, but this can be done very rapidly and without any difficulty.

Literature.[3]

One of the greatest difficulties to the beginner in the study of the Entomostraca is in connection with the literature, which, to say the least of it, is somewhat scattered. A few words on the "best books" will probably be useful, therefore, to any who may be induced to take special interest in this subject.

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[3] As stated in the foot-note at the commencement of this article, a Bibliography of the books and papers relating to the British Fresh-water species will form Part IV. of this paper.—Ed.

From the point of view of general structure, affinities, and main divisions, very good articles on the Entomostraca may be found in many text-books of Zoölogy, but special mention may be made of Huxley's *Anatomy of Invertebrated Animals*, Claus's *Text-book of Zoölogy*, and of Gerstäcker's comprehensive account in Volume V. of Bronn's *Klassen und Ordnungen des Thierreichs*. An article by J. Vosseler (106) in Zacharias's *Thier und Pflanzenwelt des Süsswassers* contains a short but very good general account of the group, and similar articles of a more or less general nature also occur in most works dealing with the microscope and microscopic objects, such as Griffith and Henfrey's *Micrographic Dictionary*, Carpenter's *Microscope and its Revelations*, &c. The facts known as to the embryology of these animals is well summarised in Balfour's *Comparative Embryology*, and more recently in Korschelt and Heider's *Lehrbuch der vergleichenden Entwicklungsgeschichte der wirbellosen Thiere* (2. Heft, 1892), a translation of which is now in the press.

Of the special works devoted to the Entomostraca, the starting point for English workers is still Baird's *Natural History of the British Entomostraca* (2), published by the Ray Society in 1850. Much of the ground covered by this classical treatise has since been re-monographed, but not so exhaustively as to render the older work quite obsolete. In fact for the Phyllopoda, Branchiura and parasitic Copepoda we have nothing in addition to Baird's work, and for the Cladocera we only possess two subsequent papers of importance, namely, Norman and Brady's *Monograph of the British Entomostraca* (56), which is confined to the families Bosminidæ, Macrothricidæ and Lynceidæ, and Brady's *British Species of Eutomostraca belonging to Daphnia, &c.* (20). For the Ostracoda we have two fine monographs, the first, *A Monograph of recent British Ostracoda* (10), by G. S. Brady, and the other, *A Monograph of the Marine and Fresh-water Ostracoda of the North Atlantic and of North Western Europe* (21), by Brady and Norman. The British Copepods have been very fully treated by Prof. Brady in *A Monograph of the Free and Semi-parasitic Copepoda of the British Islands* (16), and the fresh-water forms belonging to the Cyclopidæ and Calanidæ have more recently been revised by the same author in *A Revision of the British species of Fresh-water Cyclopidæ and Calanidæ* (19). The above are the standard works of reference on the British Fresh-water Entomostraca, but there exist in addition a fair number of smaller papers on different branches of the same subject, a nearly complete catalogue of which will be found in the Bibliography appended.

The really earnest student will, however, soon find the need of something beyond the exclusively English literature, which, after all, is comparatively meagre. On the Continent a very large number of works wholly or partially on fresh-water Entomostraca have been published. To merely enumerate a tithe of these would take much more space than can be allowed here, but some of the most useful may be referred to. Of the older works may be mentioned L. Jurine's *Histoire des Monocles* (Geneva, 1820), F. Leydig's *Naturgeschichte der Daphniden* (Tübingen, 1860), and C. Claus's *Die Freilebenden Copepoden* (Leipzig, 1863). The most important of the newer works are Weismann's *Beiträge zur Naturgeschichte der Daphnoiden* (107), Hellich's *Die Cladoceren Böhmens* (94), Vávra's *Monographie der Ostracoden Böhmens* (105), Schmeil's *Deutschlands Freilebende Süsswasser Copepoden* (103), and Richard's *Révision des Cladocères* (101). The two last named contain splendid bibliographies of their respective subjects.

[*To be continued.*]

A MANGANIFEROUS CONGLOMERATE IN ESSEX.

By T. S. DYMOND, F.I.C., F.C.S.

[*Read December 11th, 1897.*]

SOME months ago my attention was drawn by Mr. F. W. Clarke, of Tendring, to the hard flattened masses of cemented gravel occurring in that locality so near the surface as to be frequently turned up by the plough, and varying in size from a few square inches to a square yard. They are referred to in the Memoir of the Geological Survey (Sheet 48, S.W.) in the following words :—" East of Colchester the (Glacial Drift) gravel passes under a sandy loam that covers most of the County as far as Tendring, beyond which outlying patches of gravel, loam, etc., lie on a spread of London-clay. Near Little Bentley, Great Bentley, and Wivenhoe Cross the gravel is cemented by iron into a coherent mass overlying looser material" (*Geology of the Neighbourhood of Colchester*, by W. H. Dalton, *page* 3).[1] These masses are of value for building purposes, being very hard and durable; indeed, it is almost the only building stone of which Essex can boast,[2] and not only are many of the churches in North-east Essex built of it—for instance, the church of Great Bentley—but it has been conveyed apparently to considerable distances, the church walls at Danbury, for example, being largely composed of the same material.

My interest in the substance was aroused by noticing that when the cementing material was treated with hydrochloric acid, chlorine was abundantly evolved, indicating that peroxide of manganese was a constituent. As no other cemented gravel or sand that I have examined contains this substance, it seemed to be worth while to examine the Conglomerate more carefully. The cement proved to be ferric oxide mixed with the peroxide and protoxide of manganese, together with a large quantity of sand. The analysis of the air-dried substance gave the following results:—

Loss on heating at 120 °C. (water) ..	7·850
Sand and combined Silica	60·960
Peroxide of Manganese	6·505
Protoxide of Manganese	2·840
Ferric Oxide	18·315
Lime, Alumina, etc. (by difference) ..	3·530
	100·000

In this there is no simple relation between the proportions of the constituent oxides, so that the substance has little purely chemical interest, and the proportion of peroxide is far too small to render it of any commercial value. The conditions under which gravel can become cemented with a manganiferous deposit is, however, a chemical problem of considerable geological interest.

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[1] As a matter of fact, the substance is more widely distributed than is here represented and throughout the Tendring Hundred it may be found wherever gravel forms the sub-soil.

[2] Flints and septaria nodules are also used for building in Essex. Great Clacton church is largely built of septaria nodules. [T. V. H.]

A well-section from the Waterworks, Clacton-on-Sea, reveals the following strata. (*G.S. Mem.*, 48 S.W., p. 13):—

Soil	(Brown loam)	2 feet
Post Glacial Drift	Sandy clay	5 „
	Gravel	5 „
	Sand with flints	1 „
	Brown sand	5 „
	Conglomerated gravel	2 „
London-clay	Dark-grey clay	136 „
	Sandy clay	10 „
	Clayey sand	14 „
	Shelly sand	2 „
	Grey and buff clay	8 „
Reading Beds		80 „
Chalk		20 „

The Conglomerate of Clacton, therefore, immediately overlies the London-clay. Now surface soil contains protoxide of manganese in the form of silicate. This is very slowly dissolved by water containing carbonic acid and other soil acids. When such a solution is exposed for a prolonged period to oxygen, the protoxide undergoes oxidation to the peroxide, which, being incapable of forming a silicate or other salt, is precipitated in the solid form either pure or combined with more or less protoxide according to circumstances.

These facts afford a satisfactory explanation of the occurrence of this manganiferous cement, at any rate where it overlies the London-clay. Water containing manganese dissolved from the surface soil would percolate through the whole of the Post-Glacial beds. But on the surface of the London-clay the flow of water would be arrested, and thus time given for the gradual oxidation of the manganese which would be deposited in a hard coherent mass binding together the sand and stones of the gravel, thus producing a Conglomerate hard enough for building purposes. Where the Conglomerate overlies looser material, it is possible that the water has risen to some height above the London-clay, for it is upon the surface of the water-saturated gravel that the manganiferous cement would be formed.

"FRESH-WATER CHALK" AT HALSTEAD, ESSEX.

By T. S. DYMOND, F.I.C., and F. W. MARYON.

[*Read December 11th, 1897.*]

ON the slope of a little valley at Mr. C. W. Gray's farm, "Perces," Greenstead Green, Halstead, there is a very singular deposit of chalk-like material. It occurs at a depth of from 6 to 8 inches below the surface, and it is covered by soil blackened by humus. A spring of water renders the land very wet, and to this is due the accumulation of humus in the soil, the natural decay and oxidation of vegetable matter having been arrested. At the spot examined, the deposit was at least three feet thick, and may have been much more. As is seen by the Drift Map (Sheet 47), the subsoil in this locality is chiefly Boulder-clay, but in the valleys there is an outcrop of gravel with London-clay underneath, and it is on one of these that this chalk appears to be resting. No similar deposit has, as far as we know, been recorded in this locality, and it therefore seemed worth while to examine it more closely.

The chalk is soft and granular in character. Examined under the microscrope it appears as a white amorphous substance mixed with small transparent particles and devoid of the remains of any organisms. The transparent masses are undoubtedly crystalline, but it is not possible to identify the crystalline forms with either calc-spar or aragonite. Dried at 100°C and submitted to analysis it was found to have the following percentage composition:—

Lime	54·250
Magnesia	Nil.
Oxide of iron and alumina	·563
Phosphoric acid (P_2O_5)	·127
Carbonic acid (CO_2)	42·625
Silica	1·200
Organic matter and water of combination ..	1·530
	100·295

That this is a comparatively recent deposit we think there can be no doubt, for it lies above the London-clay and either in or upon the Glacial Drifts. Such a deposit might be formed in three ways:—

(1) By deposition of Mollusca and other organisms from a fresh-water lake.

(2) By deposition of carbonate of lime from spring-water super-charged with carbonic acid and in consequence super-saturated with the bicarbonate of lime.

(3) By segregation of carbonate of lime from water charged with the bicarbonate in passing from a permeable stratum into clay.

The first suggested method of formation is quite untenable for three reasons. The existence of a lake in such a position and upon such formations is extremely improbable; secondly, the substance contains no trace of any organic remains; and lastly, the chemical composition does not correspond with that of a recently formed organic deposit, for instance the chalk mud of the Atlantic Sea-bottom (see Appendix).

The second suggestion is much more likely to be correct, especially since there are springs of hard water on the very spot where the deposit occurs, and since the existence of crystals in the substance shew that the chalk has been deposited from aqueous solution. Deposits of chalk, in the form of the incrustation of sticks, etc., in the bed of a stream, are frequently observed, and it is possible that they would occur on a larger scale.

It has been observed that under the Boulder-clay a hard crystalline deposit of chalk 3 or 4 inches thick sometimes occurs (see *G. S. Memoir Geology of North West Essex*, etc., *Sheet 47, p. 60*), and is supposed to be formed from water, containing dissolved chalk, diffusing from below into the Boulder-clay, in which process the chalk is dialysed out. It seems to us that the deposit at Greenstead Green may be the outcrop of a similar deposit, existing, however, in a much thicker stratum, and at the outcrop thoroughly disintegrated by natural processes. Its chemical composition is quite in accordance with this explanation.[1]

In conclusion it may be pointed out that this chalk-like substance, if it existed in larger quantities, would be a valuable material for dressing the land for agricultural purposes. Being very soft and powdery it would act much more beneficially and rapidly than chalk in Boulder-clay; be much cheaper to cart since a smaller quantity would be required, it being nearly pure chalk instead of a mixture of chalk and clay, and lastly it would be a better dressing where the clay of the Boulder-clay is prejudicial to the land.

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[1] Mr. T. V. Holmes, F.G.S., remarks as follows:—"The spring at Greenstead Green evidently results from the saturation with water there of the Glacial Sand and Gravel underlying the Boulder-clay and overlying the London-clay. All the chalky matter thrown down there must be derived from the overlying chalky Boulder-clay, the underlying gravel being full of water to the top. Below the gravel the London-clay is from 80 to 100 feet or more thick so that there can be no doubt as to the source of the chalky material in this case."

APPENDIX.

PERCENTAGE COMPOSITION OF CHALK.

	Calcium Carbonate.	Magnesium Carbonate.	Calcium Phosphate.	Ferric Oxide.	Alumina	Silica.	Organic matter and water of combination.
Chalk, Brighton Cliffs ..	98·57	·38	·11	·09	·16	·64	
Chalk with flints, Kent ..	98·40	·10	-	·40		1·10	
Upper soft chalk with flints	96·06		·26		- -	- -	- -
Chalk, Stewartstone, Tyrone	97·32	·80		·09	·27	·53	—
Red chalk, Hunstanton ..	80·04	·00	-	9·00	1·42	9·28	
White chalk (source unknown)	95·80	1·08		1·08	·52	2·28	
English chalk (source unknown)	98·50		·46	—		·41	·38
Ooze or chalk mud, Atlantic Sea-bottom ..	58·80	1·70	3·80			30·90	4·80
Fresh-water chalk, Greenstead Green	96·87	·00	·28	·37		1·20	1·33

SIXTY YEARS OF BRITISH MYCOLOGY.

By M. C. COOKE, M.A., LL.D., A.L.S., &c.

[Read October 16th, 1897.]

THE current year has been remarkable for its varied retrospects of the last six decades, and to these we propose to add another which will cover a field not yet traversed, and one of interest to a somewhat limited section of Her Majesty's subjects. The study of Botany has advanced greatly in the present century, but in no division of that large subject has the advance been more remarkable than in that which embraces the CRYPTOGAMIA. Long after the list of Flowering-plants had assumed very respectable proportions, that of the Cryptogamia was small and somewhat confused. The study of these lower organisms was to a large extent excluded from general botany, and until very recent times the special study of Mosses, Lichens, Fungi, and Algæ had never been attempted, save to a very limited extent. If we go back to our boyhood's days, although we have but very faint recollections of the reign of George IV., the reign of William IV. was not at all an active one for Biological Science. The instrument which was called a compound microscope in those days was only a toy, and wholly useless for botanical investigation. Ferns were recognized and placed at the end of the Flowering-plants, but for the rest Mosses only were beginning to be looked at with something of scientific interest.

Previous to 1837 only one Handbook of Botany, which was in common use, can now be remembered, and that was Macgillivray's Edition of Withering's *Arrangement*, in one volume, but this was confined to the Flowering-plants, and those students who desired to gain some knowledge of the lower forms of vegetable life had to consult the complete Withering, in four volumes. Sowerby's *English Botany* did not come within the range of the ordinary student. This was the domestic era of the tinder box and rushlight, and before the first boxes of "Lucifers" astonished the natives at the cost of twopence halfpenny each. There was real astonishment in rural districts over the first box introduced amongst them. Little flat matches drawn between folded sandpaper, producing an immediate flame. "Lucifers" they were called and Lucifer, under another cognomen, was supposed to be at the bottom of the mystery.

At this time, and before the Accession of the Queen, dates the first effort in the History of British Botany, to encourage the separate study of the Cryptogamia, and it was only just in advance of that event. This was the dawning of the Victorian epoch, which commenced with the publication of Hooker's, continuation of Smith's *English Flora.* These two volumes containing the Mosses and Hepaticæ by William Jackson Hooker; Lichens, in which doubtless Borrer and Turner assisted; Algœ by W. H. Harvey, with the Diatoms by Dr. Greville; and the Fungi by Rev. M. J. Berkeley. In these names we recognize the pioneers of all that was done for nearly half a century in British Cryptogamic Botany. Hence, as far as the Fungi is concerned, the publication of Smith's *Flora Supplement*, by M. J. Berkeley, in 1833, inaugurated the special study of Fungi.

On this subject Hooker remarks in his preface regarding the Fungi "notwithstanding all that has been done by Withering, Sowerby, Purton, Carmichael, and Greville, must yet be acknowledged as the least understood of all our British Flora." If we allow our imagination to revert to this period we can soon discover from the local Floras the extent of knowledge possessed by Botanists of the Fungi of their localities. Abbot's *Flora Bedfordiensis* (1798), Jones and Kingston's *Flora Devoniensis* (1829), Greville's *Flora Edinensis* (1824), Hooker's *Flora Scotica* (1821), Hudson's *Flora Anglica* (1778), Johnston's *Flora of Berwick-on-Tweed* (1829), Lightfoot's *Flora Scotica* (1777), Mackay's *Flora Hibernica* (1836), Purton's *Midland Flora* (1817), Relhan's *Flora Cantabrigiensis* (1820), Sibthorp's *Flora Oxoniensis* (1794), to which may be added Withering's *Arrangement* 3rd edition (1796), and Gray's *Natural Arrangement* (1821).

From all these sources we discover that the total number of Fungi known for the localities determined were:—

Abbot. *Flora Bedfordiensis* (1798)	284
Jones and Kingston. *Flora Devoniensis* (1829) ..	145
Greville's *Flora Edinensis* (1824)	410
Hooker's *Flora Scotica* (1821)	212
Hudson's *Flora Anglica* (1778)	126
Johnston's *Flora of Berwick*	336
Lightfoot's *Flora Scotica* (1777)..	73
Mackay's *Flora Hibernica* (1836)	none
Purton's *Midland Flora* (1817-1821)	395
Relhan's *Flora Cantabrigiensis*	254
Sibthorp's *Flora Oxoniensis* (1794)	232
Withering's *Arrangement* 3rd edition (1796) ..	555

To which we may add for comparison—

Gray's *Natural Arrangement* (1821)	803
Berkeley, in Smith's *English Flora* (1836) ..	1390

Hence we learn that the total of British Fungi known previous to her Majesty's accession were –

1836 Berkeley's *Supplement*	1390

and afterwards—

1860 Berkeley's *Outlines of Fungology*	1450
1871 Cooke's *Handbook*	2810

It is only by comparison of statistics that we can realize the progress which was made in sixty years. From investigations made about two years ago it became manifest that the total number of species of Fungi recorded for the British Islands had advanced from the 1,390 of 1836 to no less than 5,200 in 1896, or nearly four times the original number. In the previous fifty years the total had only advanced from 555 in 1796 to 1,390 in 1836. Hence our first fact is eliminated, that the increase in the number of recorded species was nearly double the ratio of increase in the preceding half century.

This fact leads us to a second enquiry and that is, to ascertain in what section of that particular study was the increase the most remarkable. By comparison of the same authorities we can learn that the number of species of larger fungi, determinable by the naked eye, principally the Basidiomycetes, were recorded in 1836 as about 570 species, whereas in 1896 the same group was represented by 2,030 species.

On the whole it is not surprising that the increase in the larger and more conspicuous species should fall but little below the ratio for all the sections together. Especially when we take into account the readiness with which they may be seen by the pedestrian without the trouble of minute searching. But we would fain think that the large ratio has been caused by one or two collateral circumstances. The first of these has been the extension and more active operations of local Field Clubs, and especially in the organization of annual Fungus Forays. One of the earliest, and we believe the first and most successful of these organizations, was the Woolhope Naturalists Field Club of Hereford, which was not established until 1851, and did not commence its Forays until 1868, after which they became annual for about a quarter of a century. These meetings, which lasted through the greater part of the week, were the means of discovering a great many additional species, besides giving an important stimulus to field collecting. Another important organization was the Cryptogamic Society of Scotland, which performed similar work in the North to that of the Woolhope in the West. The first conference was held at Perth in 1875 and has been continued annually since. These efforts were emulated in a more humble way by other Societies, which devoted one day, or half a day, yearly to a Fungus Foray, until it became quite an ordinary occurrence for a local Field Club to have its Fungus Excursions. Unfortunately, as death thinned the ranks of the older and more experienced of Mycologists, these meetings declined much in attendance and activity, and, during the last ten years, some of them have ceased. One of the most persistent in its adherence to its one-day Fungus Foray is the Essex Field Club. And it is still matter of pride to some of its members that during the course of time a goodly number of Agarics have been discovered for the first time in Britain within the limits of Epping Forest. It only requires that the records of such societies as those of Hereford and Essex should be consulted to prove from local lists that the counties which have possessed organized Fungus Forays have obtained a considerable advance over their more sluggish neighbours, and can exhibit lists of Fungi, in addition to the ordinary Flowering-plants of their locality, which will always stand as a monument of their energy and zeal, unparalleled in the reign of any British Monarch but that of our Queen.

Another cause of the progress made in the study of the larger Fungi may be found in the production of a cheap literature on the subject, such as was never seen before. In 1847 the only volume on the Edible Fungi cost about a sovereign, afterwards a book on the same subject could be had for about half-a-crown. Moreover, for twenty years the Cryptogamic Botanists patronised and supported, without pecuniary loss to the proprietors, a quarterly journal *Grevillea* devoted solely to Cryptogamic Botany, an event which has no parallel in the history of this country, and proves that the number of students in that department must have been at its highest about that time.

Passing from the Hymenomycetal Fungi, and all or almost all those of conspicuous size, we must turn to those which require the use of the microscope for their discrimination and determination. Here it would be well to distinguish two or three large groups as a sample of the whole. If we take the

Discomycetes, or fungi of the *Peziza* type, we find some of them of a large size, but the majority are very minute and scarcely visible to the naked eye. If we take for comparison the list of species from Berkeley's *Supplement* we shall find that 154 species were recognized in 1836, whilst Mr. Phillips enumerated 607 in 1887, or just four times as many in fifty years. This marvellous increase in the number of known species must be attributed partly to the increased number of observers, partly to the energy and application of a limited number of workers, and partly to the improved condition of the microscope and the methods of microscopical manipulation. Any way it represents an important fact in the history of British mycology in the past sixty years.

Another important group are the Sphæriaceous Fungi, or technically the Pyrenomycetes, but it would be a question of time to analyse the lists of 1836 and compare them with those of 1896. We may suggest that whilst the whole of the microscopical fungi, except the Discomycetes, which were enumerated in 1836, was only 665, the number in 1896 had risen to 2,550.

One other group need be only briefly alluded to, and that is the group which contains the pests which infest garden and field crops. Some call them the Hypodermæi, but they are popularly the "Rusts" and "Smuts" so destructive to vegetation. A difference in the methods of classification would interfere with a satisfactory comparison of numbers at remote periods, but it may be taken for granted that in this department also important numerical results have been obtained in sixty years.

Up to now we have been content to trace the numerical increase of recorded species in the sixty years, but this is the poorest and most unsatisfactory way in which to report progress. Large as the numerical increase may have been this is of small account when we take into consideration the great accession to our knowledge of the life-history, development, methods of reproduction, and all that concerns the inner life of minute fungi as revealed even during the last thirty years. We have freely taken advantage of all researches and disquisition in France, Germany, Italy, Austria, and United States, to increase our own store of knowledge, if we have not contributed much ourselves. This assimilation has eventuated in our regarding numerical increase of species with less favour as an incentive to work, and a more thorough knowledge of organs and functions as of a higher value, than at any time during the past half century. We have only to refer to a few of the most important Memoirs which have been published abroad, and translated at home, to afford evidence of the great intellectual advance of mycology generally during the reign of the Queen.

We may first call to mind the writings of the Brothers Tulasne, and especially how they opened our eyes to the prevalence of polymorphism. How they prepared the way for a better understanding of the Uredines and Ustilagines, and what good service they rendered by their Memoirs on the Nidulariacei, the Tremellinæ, the Tuberacei, and others, and how they helped in the cause of progress. Then we cannot forget what Anton de Bary did with fermentation, with those Moulds which cause disease in living plants, the Peronosporei, and the "White-Rusts," and his multitudinous suggestions in other directions, which made him a power in the age in which he flourished. Brefeld also, whether we are prepared to accept everything or not, which he propounded, was another factor and an important one, in the progress of mycology. His elaborate illustrations to his papers are a marvel of patient and unflagging research such as were never dreamt of fifty years ago. Then there were Van Tieghem's papers on the Mucors, Thaxter on Entomophthora, Cornu, Pringsheim, and others on the Saprolegniaceæ, a host of exponents of Heterœcism, and almost as many on Symbiosis, which theories had no existence forty years since. Truly it has been a period of great activity in the Department of Fungi, both in classification, as witnessed by Saccardo's *Sylloqe*, and in morphology and physiology, so that the Mycologist of to-day, if he would be master of his subject, must give it his undivided attention and be content with riding but one hobby if he would ride well.

Contemporaneous with this advance and increase of knowledge has occurred a diminution or delimitation of species, especially amongst the microscopical fungi. This has resulted from a discovery that many of the genera, so called, fifty years ago, only contained immature or imperfect conditions of other fungi. This was especially the case with the Uredines, and has considerably reduced the number of the Moulds, or Hyphomycetes. As, for instance, *Uredo*, *Lecythea*, *Trichobasis*, &c., as conditions of *Puccinia* and of *Uromyces*; and *Æcidium* as an early stage in the life history of both. Again *Tubercularia* as the conidia of *Nectria*, *Isaria* as those of *Cordyceps*. Many species of *Oidium* as a condition of *Erysephe*, and so on, so that at the same time that true species have been increased, spurious species have been eliminated.

There still remains behind a great number of genera, which are retained provisionally as *Incomplete Fungi*, the life-history of which still remain for future investigation. Some of these are "Moulds" and others belong to the Sphæropsideæ. Amongst the latter are a large number of "pests" or parasites on living plants, many of them being very destructive. With some persons it is an open question whether the Myxomycetes are fungi, or intermediate organisms between fungi and the lower animals; generally, however, they are accepted as a unique and peculiar group of fungi, or at the least more closely allied to fungi than to anything else. Sixty years ago as many of them as were then known were classed with the "Puff Balls" or Gastromycetes.

Accepting then the conclusion that British Mycology has advanced considerably during the past sixty years, not only in a great numerical increase of species, but also in an increased knowledge of their structure and relationship, we are led to enquire finally what has been the principal agent which has produced this result? To this question there can be but one answer, viz.: The improved microscope and the great accession of microscopical observers. There is no group of Fungi in which the microscope has not been employed; even the Hymenomycetes, such as the *Agarics*, for instance have had to submit to investigation. Perhaps amongst these plants microscopical distinctions have been pushed to their extreme limit. It seems to be "sharp practice" to separate two *Agarics*, so closely resembling each other as to be indistinguishable by the naked eye, simply because one of them has spores which are two or three micromillimetres larger or smaller than the other. One of the greatest sinners in this respect has been Britzelmeyr, the Bavarian mycologist.

We must bear in mind that the Royal Microscopical Society was inaugurated in 1840, and that the Quekett Microscopical Club dated a quarter of a century after, hence all their work and influence falls well within the past sixty years. The full meaning of these facts will be appreciated by Microscopists, and what has been accomplished *for* the microscope and *with* the microscope during sixty years is a matter of history. As the accurate discrimination of the Cryptogamia depends so largely upon microscopical characters, it is but reasonable to predicate that the knowledge of the Cryptogamia would increase with the development of this agent.

As the nineteenth century draws rapidly to its close we who have lived through the last three quarters of it look back with proud satisfaction at all which we have individually been able to do in aid of the onward progress of this department of Natural Science, and, at the same time, look forward with hope and confidence to a glorions future which shall utilize the discoveries of the past. British Mycologists, therefore, have every reason to be satisfied and proud of the progress of mycology in the British Isles during the sixty years reign of the Queen.

THE ESSEX FIELD CLUB.

VISIT TO THE COLNE ESTUARY, AND INSPECTION OF THE COLCHESTER OYSTER FISHERIES AND BREEDING GROUNDS.

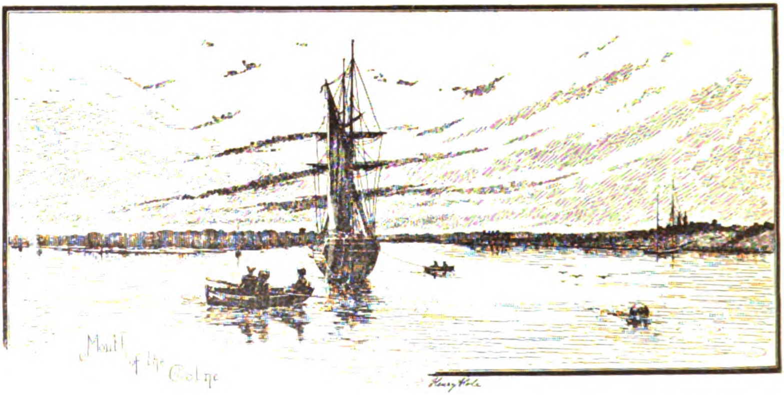
THURSDAY, SEPTEMBER 9TH, 1897.

Conductors—THE WORSHIPFUL THE MAYOR OF COLCHESTER, H. C. SORBY, LL.D., J.P., F.R.S., F.L.S, &c.; Alderman H. LAVER, J.P., F.L.S., F.S.A.; Councillor J. C. SHENSTONE; C. E BENHAM; W. COLE, F.L.S, F.E.S.; WALTER CROUCH, F.Z.S.; Councillor CLAUDE EGERTON-GREEN; E. A. FITCH, F.L.S., F.E.S; EDGAR NEWMAN; Councillor J. W. POTTER; Councillor L. J. WATTS.

When an autumnal meeting in the Colchester district was mooted, two of our most active local members (Mr. J. C. Shenstone and Mr. C. E. Benham) suggested a visit to the Colne Oyster Fisheries as likely to afford both pleasure and instruction to the members. They accordingly formed themselves into a Committee, and the very successful meeting we have now to record was largely the fruits of their exertions. Many members of the Colchester Corporation took an active interest in the event; the Colne Fishery Board very kindly lent their steam-dredging vessel, the "Pyefleet," for the occasion, and gave great facilities for the conduct of the meeting, and Messrs. W. and H. A. Cole drew up and illustrated a very handsome circular containing much information on the natural history of the oyster and the mode of culture pursued in the Colne.

The threatening skies of the previous days kept some away, and the party was not quite so large as was anticipated, nevertheless about 100 members and friends assembled at Messrs. Forrestt and Sons' ship-yard, Wivenhoe, at noon. They came from all parts of Essex, and from London, and included the President (Mr. Howard), the Mayor of Chelmsford (Mr. Chancellor), and Sir John Hall (ex-Premier of New Zealand). Dr. Sorby had sailed into the estuary in his yacht "Glimpse," and the Hon. Secretaries, with Mr. G. E. Vaughan, came over from Mersea. Great regret was expressed at the absence of Dr. Laver through indisposition, and of the Mayor of Colchester, who was prevented from being present, as was also another of our "conductors," Mr. W. Crouch. It is impossible to give a full list of those who took part in the meeting, but it filled two pages of the signature book, and included many of our best-known and most active members.

The weather quickly grew kind and favouring. The rain which fell during Wednesday night and Thursday ceased before the time of the excursion and ere the water-trip began even the clouds began to pack away, allowing the sun to shine through, and for the greater part of the afternoon there was sunshine, warmth, and of course, happiness—as the *Essex Times* put it, "when was an Essex Field Club meeting anything but happy?"



THE MOUTH OF THE COLNE. EVENING.
(*Drawn by* H. A. COLE.)

At Messrs. Forrestt's the work in the yard happened to include many shipping operations of considerable interest, which were explained by the Managing Director and by Mr. C. E. Benham. About 30 man-of-war's boats of all types were in course of construction for the Chilian Government, a very elaborate class of boat, and in some respects more so than those built for the Admiralty. There were also to be seen four torpedo launches for the Admiralty. Though only 56 feet long by nine feet beam their machinery, supplied by Mr. A. G. Mumford, of Colchester, indicates over 200 horse power. They have a speed of 14 knots and carry two torpedoes and two quick-firing guns. The "Genesta" was in the yard—the cutter which sailed for the America Cup in 1885. She has been re-caulked and coppered, and is ready to launch again after a complete overhaul. Messrs. Forrestt and Son are also building a small steel Government steamer for Port Elizabeth, in South Africa. She is ready to launch for the purpose of lifting in her machinery. Perhaps the most interesting feature was the work for the Congo Free State.

ENTRANCE TO THE PYEFLEET CREEK.

(*Block kindly lent by* MR. J. L. WATTS)

"The herring loves the merry moonlight,
The mackerel loves the wind
But the Oyster loves the dredging sang,
For he comes of a gentle kind."

Eight galvanized steel river boats were in course of building. They are adapted to carry indiarubber, ivory, and other light produce, and are paddled by the natives on the creeks and rivers in connection with the Congo to bring the produce down to the steamers running on the river. After being constructed at Wivenhoe, these boats, of which Messrs. Forrestt and Son, have made hundreds in the last 10 years, are taken to pieces and carried on the heads of natives about 1,500 miles through the forest and then put together again.

The tide, however, was falling, and interesting as the ship-building was, a hurried embarkation on board the "Pyefleet" became imperative. For fear that so large a party could not be accommodated on the dredging vessel, a smaller steamboat, the "Wyvern," had been hired from Messrs. Forrestt, but she was not much used during the day. The Police steam launch, under the command of the Chief Constable, Mr. R. O. Coombs, rendered valuable service as an auxiliary means of transport.

Scarcely had those new to the Colne finished their expressions of admiration of the breezy estuary and its picturesque surroundings, than the sun came out and lighted up the distant hills with the mellow shades of autumn, and all fears of rain were finally dispelled. Having reached that part of the river which lies between the mouth of Brightlingsea Creek and Mersea, a dredge was thrown overboard and soon the deck was covered with oysters in almost every stage of growth, except maturity. As stated above the programme had furnished the spectators with a sketch of the natural history of the oyster, and so all could readily follow the practical demonstration of the conductors and the dredgermen members of the Colne Fishery Board. Owing to the constant cleansing of the beds, very few marine animals were obtained, but great interest was shown in the abundant specimens of two or three species of Ascidians and the curious "Pipe-weed" (*Alcyonidium glomeratum*).

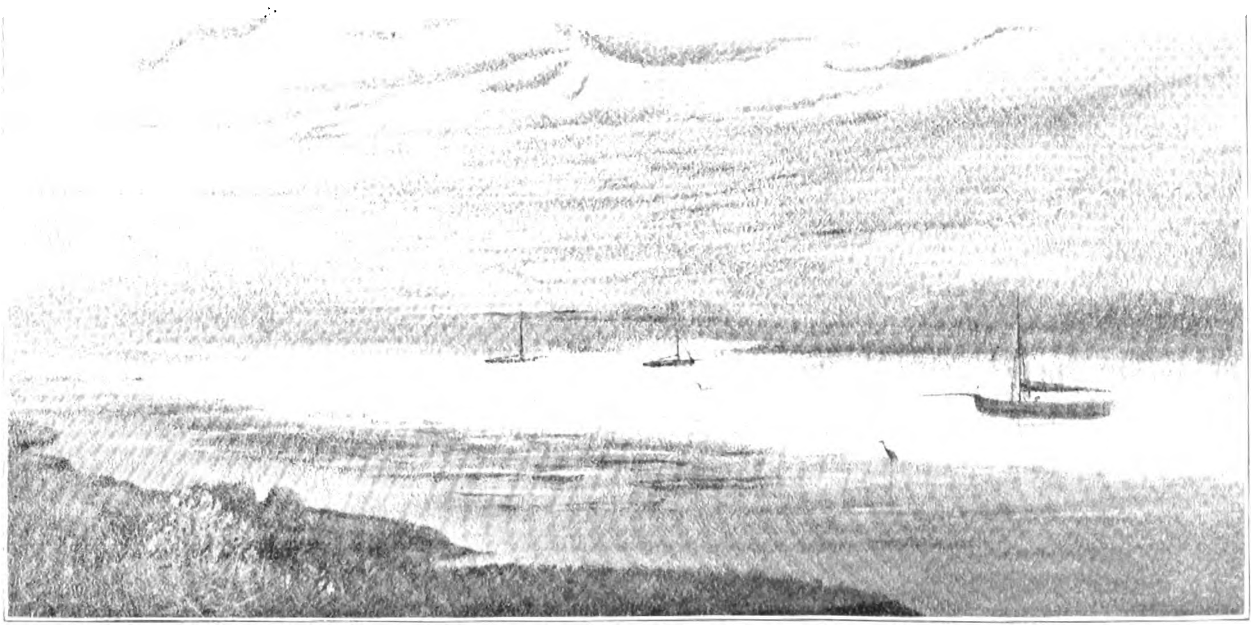
The vessel then steamed up the Pyefleet, a channel dividing Mersea from the mainland, where the oysters are relaid to fatten. At Pewit Island the whole party landed and inspected the pits in which the mature oysters are placed to keep until wanted. The dredgermen demonstrated the methods of trimming, cleaning, and packing the oysters for the market.

Then came luncheon in the Packing-house, which had been catered for in an admirable manner by Mr. J. G. Potter, of Colchester, who had brought the whole with tables and other furniture across in the police launch early in the day. It was a veritable "Oyster Feast" on a small scale, an abundant supply (1,300!) having been supplied for the party.

In the open, at an extemporised table of boards placed on oyster-barrels, the ORDINARY MEETING (the 172nd) was held, Mr. David Howard, president, in the chair.

The Right Hon. the Countess of Warwick and Mr. E. E. Turner were elected members.

Dr. H. C. Sorby, F.R.S., read a paper entited, "General Remarks on the Marine Natural History of the Colne Estuary" (*ante*, p. 166). Dr. Sorby exhibited specimens in illustration of his remarks, as well as lantern-slides of marine animals and algæ, preserved by special methods, which he was



THE PYEFLEET WHERE THE "NATIVES" ARE FATTENED. EVENING.

(*From a Painting by* H. A. COLE.)

Colchester "natives" demand almost as much care in their culture as the choicest flowers, and they are dredged up several times before being finally laid in the Pyefleet Channel, the ground of this creek having been found by experience to "fatten" the oysters better than any other part of the fishery.

then engaged in devising and perfecting.[1] Nothing more beautiful and instructive than the slides of *Sabella*, *Aurelia*, *Ophiura*, or that of a young plaice, with the aorta and arteries filled with blood, could be desired, every detail of structure being wonderfully retained. He also showed specimens well-preserved in "Formalin" (Formic-Aldehyde), especially the fairy-like *Cydippe*, which is often so common in the estuary.

Dr. Sorby further exhibited samples of solutions of colouring-matters extracted in the simplest way from Marine Algæ. The plants were placed in fresh-water, which quickly dissolves out the colouring-matter. The solution having been filtered, sugar is added to the saturation-point, in order to prevent decomposition. One of the most beautiful colours thus extracted showed the phenomena of fluorescence in a high degree, the solution being of a deep orange tint by reflected light, and a beautiful pink tinge by transmitted light. He also read a "Note on the Food of Oysters in Essex" (*ante*, p. 169.)

A hearty vote of thanks was passed to Dr. Sorby at the conclusion of his papers and exhibits, on the motion of the President, who said that such work was an example of the source of real progress in knowledge of marine life.

Mr. W. M. Webb, F.L.S., showed the original shells from which the "sciagraphs" reproduced on *Plate iii.* of vol. vi. of the *Journal of Malacology* had been taken for the purpose of proving the value of the Röntgen-rays in the study of conchology, points being brought out which could not otherwise be clearly demonstrated without cutting or sectioning the shells. The majority of the specimens formed a series showing the evolution of the Cowry-shell (*Cypræa arabica*) from a spiral, thin-lipped form to the well-known covering of the adult. Mr. Webb pointed out how, through the incurving of the lip and the formation of one row of "teeth" on its edge and another on the body-whorl opposing the first, the peculiar entrance to the shell was formed ; and again, how through the laying down of a considerable amount of pearly material and colouring-matter on the outside of the shell, by the mantle-lobes, which can be protruded to meet on its dorsal middle-line, the original colouration is hidden, and the more massive shape is arrived at. Another feature of the exhibit was the rendering visible of the *clausium* or shelly plate attached to the inside of the shells of the terrestrial *Clausiliæ* and which closes the entrance on the withdrawal of the animal after the manner of a door.

Mr. Webb also exhibited a specimen of *Crepidula fornicata*, a native of Rhode Island, U.S.A., which was attached to a foreign oyster laid down at Brightlingsea and which had, of course, been imported with the oyster.[2]

In the absence of Dr. Laver, who was announced to read a paper on the "Colne Oyster Fisheries; their history and methods," Mr. J. C. Shenstone gave some details on the subject. The substance of Mr. Shenstone's remarks will be found in the abstract of his address at the meeting at St. Osyth and Brightlingsea, September 7th, 1891 (see ESSEX NATURALIST, vol. v., pp. 257-58).

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[1] See Dr. Sorby's paper "On the Preparation of Marine Animals and Plants as Transparent Lantern-slides" in the *Commemoration Volume of University College, Sheffield.*

[2] See Mr. Crouch's paper on the occurrence of this species off the coast of Essex, in ESSEX NATURALIST, vol. viii., pp. 36-38.

Mr. W. Cole, in expressing the general regret at the absence of Dr. Laver, took the occasion to thank Mr. Shenstone and Mr. Benham for the care and trouble they had taken in arranging many of the details of the meeting.

On the proposal of the President, votes of thanks were passed to Mr. Webb and Mr. Shenstone for their communications, and to the Corporation of Colchester, its officers, and the Colne Fishery Board, for their kindness in lending the "Pyefleet," and for the facilities afforded for the meeting. The President referred to the Corporation as one of the most ancient, and certainly one of the best managed in the kingdom.

By the kindness of Mr. E. Newman, Manager of the Fisheries, specimens were shown of oysters in various stages of growth, foreign as well as native, and it was intimated that a series would be got together for the Club's Museum. In reply to a question, Mr. Newman said that there were about three millions of oysters then fattening in the grounds.

The rest of the afternoon was spent in rambling over the island, where the oyster-pits were inspected, and details of the culture explained. The island is very rich in estuarine plants, and some magnificent patches were seen of Golden Samphire (*Inula crithmoides*) Sea-Starwort (*Aster trifolium*), Glasswort (*Salicornia herbacea*), Sea Purslane (*Obione portulacoides*), and species of *Atriplex*. The Sea Lavender (*Statice limonium*) was in extreme abundance and luxuriance, as was also the Seablite (*Suæda maritima*.)

VIEW ON MERSEA, SHOWING ENTRANCE TO THE BLACKWATER ESTUARY.
(*Drawn by* H. A. COLE.)

Before leaving Pewit Island tea was served in the packing-house, and the tide being now at its lowest a return to Wivenhoe was not practicable, the landing was therefore at Brightlingsea, whence the party took the train homewards. The return journey was lengthened by a pleasant trip down the Colne Estuary, as far almost as the mouth of the Blackwater. A convenient concession was kindly made by the Great Eastern Railway Company, who caused the 7.10 up train from Clacton to call and take up at Wivenhoe those of the party who were destined for London, and thus a long and enjoyable day was afforded, all the arrangements for which passed off without any hitch or mishap.

ANNUAL FUNGUS FORAY.

SATURDAY, OCTOBER 16TH, 1897.

THE Annual Cryptogamic Meeting was held on this day, the head-quarters for the meeting being Warren Hill House, Loughton, on the very kind invitation of Mr. and Mrs. S. H. Johnson.

The arrangements were much the same as those adopted at all these meetings since the first on October 2nd, 1880. The *Conductors* were :—Dr. M. C. Cooke, M.A., LL.D., A.L.S., Prof. G. S. Boulger, F.L.S., E. M. Holmes, Esq., F.L.S., George Massey, Esq., F.L.S. (*Principal Assistant, Cryptogamic Department, Kew*), E. D. Marquand, Esq. (*Kew Museum*), and the *Hon. Secretaries.*

A very large attendance of members interested in Botany was a feature in the day's proceedings ; we were also favoured with the company of several well-known London botanists, non-members of the Club, and many of the botanical students of the Pharmaceutical Society.

The morning party assembled at Chingford Station at 11 o'clock, and the members and visitors were driven in two large brakes to Honey Lane Quarters, and then to the Theydon Woods, alighting at Oak Hill, for a ramble through the very pleasant and productive woods in this part of the forest.

Luncheon was taken at the "Wake Arms," and at about half-past two an assembly was called at High Beach, to which *rendezvous* a large additional party of members and friends came from Loughton Station, Chingford, &c., &c.

A long collecting ramble was then taken in Monks Wood, through Debden Slade, Black Bushes, Strawberry Hill, and so to Warren Hill, which was reached about five o'clock.

At Warren Hill House, the party (nearly 100 in number) was most warmly welcomed by Mr. and Mrs. Johnson and family. The large hall of the house was set out with tables, and devoted to the display of specimens and other exhibits, and tea was served in the billiard room.

After tea, the billiard room was cleared, and set with chairs, and in it the Ordinary Meeting (the 173rd) of the Club was held.

The President was absent from home, and the chair was taken by Prof. R. Meldola, F.R.S., *Vice-President.*

The following were elected members of the Club :—Mrs. F. Coles, Dr. W. B. Nicholson, Messrs. Arthur C. Coffin, B.A., Inter. B.Sc., W. H. Short, and F. G. Whittle.

The Chairman proposed that the best thanks of the Club be given to Mr. and Mrs. Johnson for their kindness and hospitality in the reception of the very numerous company that evening. In the years past the Club had assembled under varying conditions, climatic and otherwise, but seldom had they found such a very cordial welcome as had been extended to them under that roof. This proposal was carried by acclamation, amid hearty cheers.

Mr. Johnson expressed the pleasure of himself and Mrs. Johnson at welcoming the Club at their house, and said that their only desire was that the members and visitors should spend a pleasant and profitable evening.

Dr. Cooke, in reporting upon the day's collecting, called attention to the comparative abundance of fungi that autumn in the forest, as evidenced by the number of species shown upon the tables that evening, larger than for many years past. He had not had sufficient opportunity for the minute examination of some of the species, which was difficult by artifical light, and up to the present no species new to the published forest flora had been detected.

Mr. George Massee, F.L.S., said also that he had not observed any new species, but the gatherings had been exceptional in quantity and variety, including some very unusual forms, and promised well for future research in the forest. Remembering the large attendance of members, he hoped that they might look forward to some good cryptogamic work being done by the Club. It would be a mistake to suppose that they had "done" the forest from a botanical point of view. The minuter species had not been thoroughly worked out yet, and, still more important, there was the task of investigating the "life-history" of each form. They could count upon their fingers—probably on the fingers of one hand—the species of which the complete life-history was known. This indicated the line of promising investigation. They wanted to know why the species appeared at all under their present forms. There must be a definite reason, a general law, and the sooner they discovered and recognised that law the better. Mr. Massee then spoke of the economic value of the accurate biological study of the minuter fungi. In the ramble through the woodlands that day he noticed many trees which were going wrong, obviously through the attacks of fungi. In this branch of study they had a field which was practically unworked, but which was well worthy of being diligently worked at—the knowledge of plant diseases turned mainly upon mycology, and the biological and experimental study of these minute plant-parasites was one not only of scientific interest, but of great practical importance to the forester and arboriculturist.

Prof. Boulger, in the course of his remarks on the day's observations, spoke of the remarkable way in which the aspen was spreading in the forest, in many places to an extent which would speedily alter the appearance of some of the woods. When he first knew the forest, the aspen was not noticeable; now one could not walk through it without being struck with the coming abundance of the tree.

Prof. Meldola said that, when in Canada that autumn, he was told that when a wood was burned down the tree which first grew up on the cleared space would be the Canadian representative to our aspen—the *Populus tremuloides*. He had asked one of the Canadian Forest Authorities, who did not know our country, what he would expect to happen in England in such a case, and the reply was that if aspen was in the neighbourhood it would certainly assert itself, and then the birch, and then that there would be a struggle between the two, in which probably the birch would survive.

Dr. Cooke then read a paper, entitled "British Mycology during the last Sixty Years," showing how great had been the advance made during the Queen's reign in this department of botany. The paper will be printed in full in the ESSEX NATURALIST.

Remarks on Dr. Cooke's paper were made by Mr. Massee and Prof. Boulger, and the Chairman proposed, amid applause, that a special vote of thanks should be accorded to Dr. Cooke in appreciation of his share in the great advance made in the study of Fungi during Her Majesty's reign, and in particular for the very valuable services Dr. Cooke had rendered to science and to popular education by the number and excellence of the works he had written, and for the assistance he had always been so ready to afford to beginners and earnest students.

This proposal was seconded by Mr. Massee, and carried, amid every mark of appreciation.

Dr. Cooke replied, in feeling terms, and said that his greatest pleasure had always been to assist and encourage the young student.

Some time was spent in examining the numerous specimens on the tables, and then the company took leave of their kind host and hostess.

THE 174th ORDINARY MEETING.

SATURDAY, NOVEMBER 27TH, 1897.

THE 174TH ORDINARY MEETING was held at the Head-quarters, in the rooms of the Epping Forest Art School, 8, Knighton Villas, Buckhurst Hill, at seven o'clock, Mr. David Howard, President, in the chair.

The following were elected members of the Club:—Miss Rhoda Crump, Mr. W. M. Paterson, and Mrs. Adair Roberts.

The Secretary announced that the first Annual Club Supper would take place at the Forest Hotel, Chingford, on Saturday, December 11th, and that an ordinary meeting would be held on the same evening.

The Secretary also stated that the difficulties in the way of establishing a permanent County Museum of Natural History, had been very largely removed by Mr. Passmore Edwards' generous offer to build a Museum at Stratford (adjoining the new Technical Institute in the Romford Road) to contain the Club's collections. The Town Council of West Ham had accepted Mr. Edwards' offer, and arrangements were being made between the Town Council and the Essex Field Club, whereby the Museum would be maintained by grants from the Corporation and the Club (the scientific curating being in the hands of the Club) as a public local Museum of Natural History and Antiquities. This Museum would illustrate the county of Essex generally, and would also contain educational collections, while the Museum at Queen Elizabeth's Lodge, Chingford, would be confined to collections and objects from Epping Forest—the two Institutions being mutually dependent and illustrative, the one of the other. As soon as the details were arranged, a full statement would be placed before the members.

The President said that it was a source of great pleasure and satisfaction that the long labours of the Club with this object in view—the permanent establishment of a local Museum—were now likely to be crowned with success, and that the hope that two really good Institutions of the kind, on however modest a scale, was likely to be realised in a few months' time.

Mr. D. J. Scourfield read a very interesting and exhaustive paper on the "The Entomostraca of Epping Forest," being the result of seven years research in the forest. Mr. Scourfield illustrated his remarks by his own drawings, microphotographs, diagrams and black-board sketches, &c.

A discussion was carried on by Prof. Meldola, the President, Mr. W. Cole, and the author, who was cordially thanked for his valuable paper, which will appear in full in the ESSEX NATURALIST (see Part I in present issue, commencing page 193).

Prof. Meldola's report on the Conference of Delegates of the Corresponding Societies at Toronto, was postponed until the next meeting.

At the close of the meeting, Mr. Scourfield gave a demonstration of many living species of Entomostraca collected that afternoon in the forest, including *Cyclops vernalis* (*male and female*), *Daphnia pulex*, *Dioptomus fuscata*, and the "ephippium," or "resting-egg," of *Simocephalus vetulus*. Also a long series of micro-photographs of Entomostraca from actual specimens. He was assisted in the demonstration by the loan and manipulation of microscopes by Messrs. Dennis, Sidwell, and Hill, and by the loan of instruments by Mr. W. M. Webb and Miss E. F. Howard.

Tea and coffee were served, as usual, at the end of the meeting.

FIRST ANNUAL CLUB SUPPER AND 175th ORDINARY MEETING.

SATURDAY, DECEMBER 11TH, 1897.

AS announced on the two circulars issued previous to this meeting, the Council proposed to establish an "Annual Club Supper for the purpose of bringing the members and friends together in the winter, when Field Meetings are in abeyance, and so promoting friendliness and unity of work and interests among them." The idea was warmly welcomed by many members, and accordingly the first assembly of the kind took place on the above evening at the Royal Forest Hotel, Chingford.

The members and visitors assembled at six o'clock in the Masonic Room, and were received by the President and officers. Numerous exhibits were placed upon the tables, and tea and coffee were served.

At half-past six an Ordinary Meeting (the 175th) was held, Mr. David Howard, President, in the chair.

The following were elected members of the Club:—Messrs. F. Enock, F.L.S., F.E.S., Julian M. V. Money-Kent, and Henry Spence.

Prof. R. Meldola, F.R.S., who had acted as the Club's Delegate at the Conference of Local Scientific Societies of the British Association at Toronto, gave a brief verbal report of the proceedings of the Conference.

Prof. Meldola then delivered a lecture, entitled "A Holiday Trip from the Atlantic to the Pacific" being notes of his journey as one of the party of distinguished British Associationists invited by the Canadian and Pacific Railway Company to take a trip from Toronto to Vancouver Island after the B. A. Meeting at the former place.

The lecture was illustrated by a long series of photographic lantern-slides lent by Dr. Mills, and the C. and P. Railway Company, which enabied Mr. Meldola's descriptions of the magnificent and varied scenery of the long journey of 3,000 miles, to be realised by his audience.

Prof. Meldola was cordially thanked for his address on the proposal of the President, who made some appreciative remarks on the same.

Mr. T. S. Dymond, F.I.C., then read two papers, one on "Manganiferous Conglomerate in Essex," and the other on "Fresh-Water Chalk," the latter paper being written in co-operation with Mr. F. W. Maryon.

The papers were illustrated by photographic slides of the maps of the districts, &c., and by specimens of the minerals. The authors were thanked for the papers, (which will appear in the ESSEX NATURALIST,) and the meeting came to an end.

The Supper was served in the great room of the Hotel; 49 members and friends sat down, the President being in the chair, supported by the Treasurer and the Hon. Secretaries, and the vice-chairs were filled by Prof. Meldola, Prof. Boulger, Mr. Walter Crouch, and Mr. T. V. Holmes, all Vice-Presidents of the Club.

A very pretty menu-card, with a view of Connaught Water, showing Queen Elizabeth's Lodge in the distance, had been designed specially for the occasion by Mr. H. A. Cole.

Only two toasts were given by the President, "Her Majesty the Queen and "Prosperity to the Essex Field Club."

During the evening, exhibits were shown by the Canadian and Pacific Railway Company, by Messrs. Watson and Sons, of Sciagraphs, by Mr. Freshwater, of some very fine micro-photographs, and Mr. C. E. Benham, of Colchester, brought up some of his recent results in experimenting with diffraction colours, varnish films, the spectrum-top, &c.

Although not so numerously attended as could be wished, the experiment may be considered a success; it will be a matter for consideration before next winter whether London would not be the most convenient place for the supper for the majority of the members.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Slaughter of Otters at Manningtree and Brightlingsea.—Mr. Porter, a local fisherman, shot a handsome dog otter on the tidal water of the River Stour, at Manningtree, on November 11th, 1897. It measured 51½ inches, and weighed 29¼ pounds. The capture of another specimen is thus recorded in the *County Standard* of December 18th:—"As Mr. F. W. Bacon, of Morses Farm, Brightlingsea, was snipe shooting on Dec. 11th on his marshes, his little fox terrier on approaching some bushes, became very excited and at once entered, when out jumped a large otter into the water, which is very shallow just there and full of reeds, the little dog following. Then commenced a tussel, and seeing the otter was having the best of it Mr. Bacon was obliged to shoot it. On pulling it out of the water it was found to measure from mouth to tip of tail just 4ft. and weighed 27lbs. It is being preserved by Mr. Pettitt, taxidermist, of Colchester."

Otter at Finchingfield.—It is reported that a fine dog Otter was caught on January 31st, 1898, by Mr. W. Jealous, on the River Cant, at Robjent's Farm.

Seal at Latchingdon.—On the occasion of the disastrous high tide on the afternoon of November 29th, a seal was captured in Bridge Marsh Creek. I have not at present been able to get fuller particulars.—EDWARD A. FITCH, Maldon.

AVES.

Owls Needed in Wanstead Park.— Mr. W. H. Rushen writes in *Nature Notes* that "visiting Wanstead Park in September, I noticed a Kestrel hovering over the big lake, but a few owls must be sadly needed there. Standing perfectly quiet among the rushes near the refreshment-house, I was in a few minutes almost surrounded by rats, quite a dozen of them, all ages and sizes. The place seemed to swarm with them, but perhaps, by now a chance owl will have discovered this happy hunting-ground, and thinned them out a little."

Another Essex Heronry.—To the four heronries still existing in our county (*see E. N.* ii, 171 and Christy's *Birds of Essex*, pp. 180-4), I am now able to add a fifth. It is a new one, but I trust that under Mr T. Knight's care it may be protected and continue to enlarge. Four years ago there were five nests in Tyle Hall Grove, Latchingdon ; their number has gradually increased, and this year there were thirteen nests, the occupants of which were all successfully hatched off. As I have previously recorded (*E. N.* ii. 174) single nests have been known in the parish before, but now a fair sized colony seems likely to establish itself, although the wood selected is quite small. At Motts (or Moats) Farm, more generally known now as "The Buildings," St. Lawrence, there were two heron's nests for several years on a large elm tree in the fence of the meadow at the back of the premises ; then but one nest until two years ago when the pair of herons commenced building, but the rooks drove them away ; this year they have not been seen. They were carefully preserved by Mr. W. R. Laver. Battles between the herons and rooks were frequent.—EDWARD A. FITCH, Maldon.

Grey Lag Goose (*Anser cinereus*) **and Brent Goose** (*Bernicula brenta*) **near Broxbourne.**—I shot two specimens of the Grey Lag Goose in the Lea Valley, near Broxbourne, during the severe weather which occurred in February, 1895 ; and one Brent Goose in the same neighbourhood, and about the same time as the Grey Lag.—E. JENARD WILLS, Nazeing.

Another Essex Decoy.—In the third part of our colleague's, Mr. W. C. Waller's, interesting and valuable article on Essex Field-Names contributed to the *Transactions of the Essex Archæological Society* we read (among the other Decoy names) of "Decoy Pond Mill" in the parish of Southminster (*l.c. N.S.*, vi. p. 264). The Rev. W. H. Lowder, Vicar of Southminster, tells me that there are two references to this in his Tithe Award and Map ; they are both on the New Moor Farm. No. 184. "Decoy Pond Field ; ' No. 185. "Decoy Pond." Mr. W. A. Hurrell, of Southminster, writes me under date October 27th, 1897. "I was at the New Moor Farm yesterday, and made inquiries ; no one seems to know anything about a Decoy Pond, but they say there is a place toward the marshes that looks like an old pond, and where osiers now grow, so I presume that would be the place." From other inquiries I have made, I cannot learn of anybody who has any recollection of a Decoy on New Moor, so presumably it has been given up for a considerable period. But the record is noteworthy, and adds to the number (32) described in Christy's *Birds of Essex*. In the list there given this Southminster Decoy will come between numbers 1 (South Hall, Paglesham), and 2 (Grange, Tillingham), *see* p. 59.—EDWARD A. FITCH, Maldon.

Garganey ("Summer Teal," *Querquedula circia*) in the Lea Valley.—On February 16th, 1890, I flushed a duck from a reedy pond in the Lea Valley, which, on being brought to bag, proved to be a fine male specimen of the Garganey. The bird was stuffed, and is still in my possession.—E. JENARD WILLS, Nazeing. [This bird appears to be decidedly rare in Essex, and Mr. Christy says that it is chiefly seen when on migration. No record is given of its occurrence in the Lea Valley, nor indeed anywhere inland. —ED.

Spotted Crake (*Porzana maruetta* Leach) in the Lea Valley, Essex.—In my opinion this bird is by no means so uncommon as is generally supposed. For some years I was the happy owner of an absolutely perfect spaniel who was particularly excellent for water work. During the season of 1890, I obtained two specimens on a sewage farm near Lea Bridge. On the 1st August, 1891, the aforesaid spaniel caught two, and flushed another which I shot on the banks of the Lea near Roydon. On October 19th, 1895, when shooting with Mr. J. Bryer, two specimens were obtained from the rushes growing in an old sand pit, quite a mile from any piece of water. During 1896, my game-book records nine spotted crakes, all shot near Waltham Abbey. All these birds have been carefully identified, and cannot have been mistaken.—E. JENNARD WILLS, "Snows," Nazeing.

Woodcock (*Scolopax rusticula*) in the Forest.—Mr. Sydney Butt, one of the Forest Keepers, reports that he many times saw a pair of Woodcocks during December and January in Black Bushes, and near the Connaught Lake, and we understand that others have seen Woodcock in the Forest during the winter.

"Double Snipe" (Great Snipe, *Gallinago major*) at Waltham Abbey.—I shot the only specimen of this bird I have ever seen in Essex on February 27th, 1897. It was flushed on a marsh near Waltham Abbey, and weighed just 8 oz.—E. JENARD WILLS, Nazeing. [According to Christy's *Birds of Essex*, the "Double Snipe" is not unfrequently seen in Essex in the autumn, but very rarely in the spring.]

Black-throated Diver (*Colymbus arcticus*) at Ramsden, Essex.—Mr. Charles Smoothy, of Little Baddow, reports that a specimen of this bird was found at Ramsden on January 18th, 1898. It appeared to be quite exhausted, and was nearly dead, although in good condition, and, no doubt, got lost in the late fogs, which would account for its occurrence so far from the coast. It was a young bird in immature plumage. Christy (*Birds of Essex*) says that "it is a somewhat rare visitor to the Essex coast in winter, and individuals are occasionally found in an exhausted condition at places far inland, after high winds or storms." In Volume iv., of our *Journal of Proceedings E.F.C.* two specimens are recorded—one at Chignal St. James and one seen by Mr. Lister on the water at Wanstead Park.

PISCES.

Conger Eel (*Conger vulgaris*, Cuv.) **at Foulness Island.**—According to the *Evening News* of December 17th, 1897, " A gentleman shooting on the saltings on Foulness Island unexpectedly came across a large Conger eel, which had evidently been left high by the recent flood. It measured six feet long, and weighed between 30 and 40 pounds."

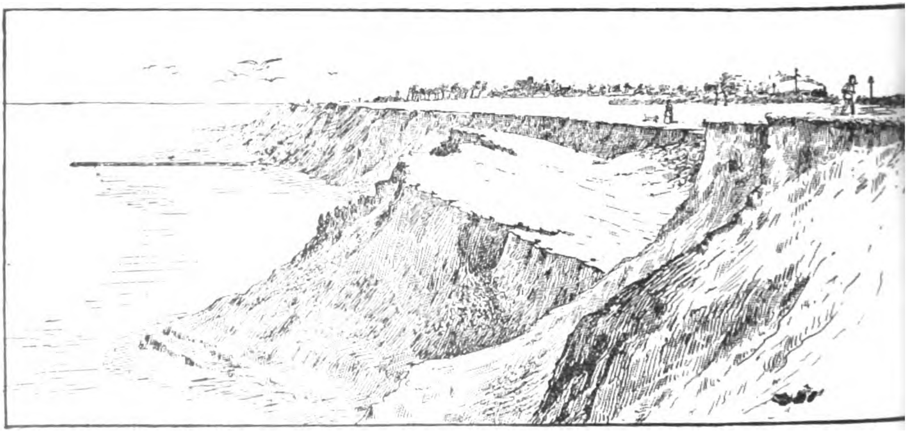
INSECTA.

LEPIDOPTERA.

Clouded Yellow Butterfly at Maldon and Purleigh.—On August 4th last, I saw a male *Colias edusa* flying over my saltings here, and upon reaching home I found that my son Richard had captured a male of the same species in the orchard. It could not have been the same specimen, as it was caught before we saw the others. These are the only *C. edusa* that I have seen this season, but the Rev. G. H. Raynor and Mr. Hatton took two males and a female in one of my fields at Purleigh (*see Entomologist* xxx, p. 269).—Edward A. Fitch, Maldon. [I rode through Essex in the last week in August, and during September kept a constant look-out for butterflies on the coast at Mersea and St. Osyth, but saw no *Colias*. It was certainly extremely rare this summer.--W. Cole.]

GEOLOGY.

Serious Subsidence of the Cliff at Walton-on-the-Naze.—The storms and high tides of November and December brought about the catastrophe which had been anticipated by several observers at Walton.



The Cliff Subsidence at Walton-on-the-Naze, December, 1897.

Early in November fractures in the soil of the field at the top of the Cliffs were noticed at a point of the coast comparatively unprotected, between Walton and Frinton and about a quarter-of-a-mile from Walton Pier. These cracks were attributed to the dryness of the soil. The fissures gradually increased in size, and spread over a wider expanse. In the central portion of the area of the crevices (about 70 yards, with an extreme breadth of about 30 yards), the land sank several inches, while towards the sea, as if forced off by the thrust of the immense mass behind (estimated at 20,000 cubic yards), a considerable portion of soil fell down to the beach, leaving the face of the Cliff perpendicular. The extent of the slip is about 70 yards in length, with a depth of about 30 yards. The footings of the Cliff at this place are not protected, and have long been exposed to the full force of the sea. The wash of the waves will probably eventually absorb the *debris* thus cast down. A few years ago it was intended to place a groyne (in addition to the one shown in the view) opposite the place where the slip has now occurred, but unfortunately the project was abandoned on the score of expense. The view draughted by the skilful pencil of Mr. W. G. Benham (for the loan of block we have to thank our member, Mr. C. E. Benham, of the *Essex Standard*), is taken from a point just beyond Burnt House Farm, and facing Frinton-on-Sea, the church of that place being shown in the distance. The slip brings the edge of the Cliff to within 50 yards of the fence of the Great Eastern Railway line (a circumstance uncomfortably noticeable to travellers to Walton as soon as they have left Frinton Station), and about 42 yards of the large water-main which brings Walton its supply of drinking water from Manningtree. It is therefore imperative that no time should be lost in preventing further encroachments at the spot, by the construction of further groynes, as advocated by Mr. Bruff, or in some other way. The circumstance has some geological interest, as showing how rapidly under certain circumstances considerable changes in the coast line may have happened. The land from Burnt House to Frinton is constantly diminishing. The value is small except for agricultural purposes, and would not repay private expenditure for its protection and preservation.

METEOROLOGY.

Rainfall and Temperature in Essex in 1897.—The following reports from some of the observers in Essex may be worth bringing together :—

Lexden near Colchester.—Mr. S. F. Hurnard thus records the monthly totals for rainfall at Lexden, as taken by a 5-in. certified gauge, read daily :—

Month.	Totals	Remarks.
Jan. ..	2·09	No intense frost.
Feb. ..	2.33	Exceptional floods on 6th.
March.	2·97	February and March very mild.
April..	1·66	Vegetation forward.
May ..	·82	Very cold 10th to 13th.
June ..	2·62	Severe thunderstorm, 24th—no hail.
July ..	·47	Hot and dry.
Aug...	2·04	Early harvest in the dry.
Sept...	2·98	Root crops flourishing.
Oct. ..	·48	Beautiful autumn month.
Nov...	·93	Mild—gale on 28th.
Dec...	1.77	Unsettled, but frost from 20th to 26th.
Total	21·16	

Fingringhoe.—Mr. Thomas B. Grubb communicates the following summary of the Rainfall and Mean Temperature at Fingringhoe for 1897, taken each day at 6 p.m.:—

	Rain.		Temperature. Mean of			
	Inches.		Max.	Min.		Average.
"January	2·32	....	37·80	31·68	..	34·74
February	2·25	....	45·68	38·11	..	41·89
March ..	2·94	....	50·30	39·42	..	44·86
April	1·79	....	51·90	39·53	..	45·71
May	0·57	....	59·10	43·48	..	51.29
June	2·35	....	68·67	53·03	..	60·85
July	0·45	....	71·42	54·03	..	62·72
August ..	2·29	....	71·26	54·00	..	62·63
September	2·58	....	60·47	48·13	..	54·30
October..	0·43	....	56·10	44·30	..	50·20
November	0·96	....	48·80	41·03	..	44·91
December	2·12	....	43·61	35·00	..	39·30
Total....	21·05, against 20·90 in 1896.					

"Greatest rainfall in 24 hours 0·91 on Sept. 30th. Highest shade temperature 83 degrees on June 24th, lowest 22 degrees on January 18th. January, as usual, was the coldest month and July the warmest, closely followed by August. The rainfall from May 24th until the end of August was mostly in the form of local showers, which varied greatly in amount even in adjoining parishes. Fingringhoe missed all the heavier showers, and it seems to be one of the driest spots in England. We had practically uninterrupted drought from June 24th until August 25th, and from May Day until June 9th. . . . . The rain and hailstorm of June 24th will be fresh in the memory of every one. Here we had a few large lumps of ice, but not enough to do much harm, but we had approaching ¾ inch of rain in 15 to 20 minutes, accompanied by a gale of wind, washing the root lands badly, and laying all the stronger corn. . . . The general feature of the summer has undoubtedly been somewhat frequent and very local thunder-showers, which seemed to avoid some districts and come repeatedly to others. The county will long have cause to remember the meteorology of the Queen's Diamond Jubilee year for the two disasters it brought—viz., the hailstorm of Midsummer Day and the tidal wave and inundation of November 29th."[1]

Chelmsford.—Mr. F. Chancellor thus summarises his daily observation of Rainfall at Chelmsford in 1897:—

"January	..	..	1·98	July ..	..	..	0·56
February	..	..	2·39	August	..	..	2·30
March	..	..	3·49	September	..	..	2·48
April ..	..	..	1·68	October..	..	..	0·67
May ..	..	..	0·84	November	..	..	1·05
June ..	..	..	3·33	December	..	..	2·21
							22·98

"The number of days upon which rain fell was 156. It is somewhat curious, but I find that the average rainfall for the last 30 years is 22·98, exactly the rainfall for this year. The average number of days for the last ten years upon which rain fell was 134."

---

[1] A Report on the Tidal Wave of November 29th, 1897, will appear in the next part of ESSEX NATURALIST. ED.

Billericay.—Mr Burnett Tabrum, of "Norsey Manor," reports that during 1897, 21·93 inches of rain were measured at Billericay. "The greatest fall on any single day was June 8th, when we measured 1·16 inches. On the day of the great storm, June 24th, we measured ·32 hail and rain. Snow fell on 13 days."

North of London.—For comparison with the above we give the registers of our member, Mr. E. J. Bentley, at Cazenove Road, Stoke Newington, N., on the Middlesex side of the Lea river. Mr. Bentley's total for 1897 was 27·93 inches. "The wettest month was September, when rain fell on 15 days, 3·57 inches. I registered for July exactly four inches, when rain fell only on five days but on the 21st July, the day of a severe storm, I registered in two and a-half hours, 3.18 inches, a very high record, and not reached in so short a time for a number of years in the North of London. The driest month was October, when only 0.55 inches fell in ten days. The number of days when rain fell was 162."

	Inches.		Inches.
"January	1·82	July	4·00
February	2·88	August	2·69
March	3·21	September	3·57
April	1·95	October . ..	0·55
May	1·47	November	1·08
June	2·42	December	2·29
		Total	27·93

Notes on Meteorology at Colchester.—"Meteorological readings have been taken daily at the Borough Surveyor's Office, Stanwell Street, for the past eleven years. On July 21st, 1897, there was a record flood, 1·76 inches of rain falling in 24 hours; 1·57 ins. in one hour only. The extreme Barometric readings for 1897 were 30·80 on Nov. 20th, and 28·55 on March 3rd, the highest and lowest readings recorded being 30·90, June 9th, 1896, and 28·40, Nov. 11th, 1891. The hottest day for 1897 was June 24th, when the thermometer rose to 91 degrees, the highest reading in previous years being 91 deg. on July 21st, 1896. The coldest day in 1897 was Jan. 17th, when there were 12 deg. of frost registered, the coldest day recorded being in Feb., 1895, when the thermometer dropped to zero. The period of longest drought in 1897 occurred in October and November (usually a rainy season) when only 14 points or one-seventh of an inch fell in five consecutive weeks and 29 points in six weeks. 24·50 inches of rain fell, this being the wettest year recorded, excepting 1892, when the rainfall reached 26·68 ins. The driest year recorded was 1887, with a rainfall of 17·27 ins. There were 139 days in which rain fell in 1887. In 1894 there were 188 wet days, the greatest number recorded, and in 1895 131 wet days, the least number recorded in one year."—From the *Essex County Standard*, January 29th, 1898.

Storm in Essex in A.D. 1565.—We take the following from the *Essex County Chronicle* of December 24th:—"The tornado which devastated such a large area in central Essex last June appears from old records to have been something like a repetition of a dreadful storm over much the same area in 1565. In this year was published "a boke intituled 'The lamentation for ye Towne of Chensford, Wrekell (Writtle), Sprynfyde, Ip(s)wich, and Waltham,'" and "A ballett intituled 'The lamentation of Chensford, Wrekell, Ip(s)wich, Spryngfylde, and Waltham.'" Stow (in his *Annales*, 1601), thus narrates the occasion of this lamentation:—"The 16 of July, about nine of the clocke at night began a tempest of lightning and thunder, with showers of haile, which continued till three of the clocke the next morning, so terrible, that at Chelmsford in Essex 500 acres of corn were destroyed, the glasse windowes on the east side of the towne and the west and south sides of the Church were beaten downe, with also the tiles of their houses, besides diverse barnes, chimneies, and the battlements of the church, which were overthrowne. The like harme was done in many other places, as at Leedes, Cranebrooke, Dover, etc." While Stow correctly writes of the county town as Chelmsford, it is interesting to note that both in the 'boke' and the 'ballet' of lamentation the town is described as 'Chensford,' because even to this day it is not uncommon to hear people in the country districts around talk of 'Chensford' and 'Chinsford.'"

MISCELLANEA.

Jubilee Medal.—Our members will be pleased to hear that Her Majesty the Queen has conferred a Jubilee Medal upon Prof. R. Meldola, F.R.S., the first President of the Club, and now one of the Permanent Vice-Presidents.

The English Earthquake of December 17th, 1896.—An exhaustive paper on this earthquake as it affected Hertfordshire, by Mr. H. G. Fordham, appears in *Trans. Herts. Nat. Hist. Soc.*, vol. ix., pp. 183-208. The shock was felt over the whole area of the County, but the structural damage was of the slightest. The observations show that a terrestrial undulation took place, the movement being compared by most recorders to that of a ship under which one or more waves were passing. The author could not learn that it extended into Essex. This is, of course, an error, as the Report in the ESSEX NAT. for 1896 (vol. ix., page 258) demonstrates. Mr. Fordham draws attention to the E. F. C. Report on the E. A. Earthquake, 1880, as "a model of what may be achieved in this branch of scientific investigation by a local Scientific Society. It is perhaps the only monograph extant of a modern British earthquake. Complete and exhaustive as it is, and highly valuable as a record, it is also well worth study as an example of an enquiry, and as a guide to systematic observation and to the collection of facts in an investigation of great extent and difficulty." We still await Dr. Davison's monograph of the 1896 Earthquake.

Errata in last part of E.N.—We regret that several errata and "literals" occurred in the last part. Readers are requested to make the following corrections:—*Page* 166, *line* 2 *from bottom should read* "*Cydippe* is sometimes common, and small Crustaceans like *Idotea*," &c.; *page* 176, *line* 8 *from top*, for "intending" *read* "intending"; *page* 179, *line* 23 *from bottom*, *for* "hospital" *read* "hospitable"; *page* 179, *line* 9 *from bottom*, *read* "Lady Marjorie Greville"; *page* 188, *line* 9 *from top should read* "now shared by many naturalists. Bearing in mind," &c.; *page* 188, *lines* 4 *and* 9 *from bottom*, *for* "*Ocynus*" *read* "*Orcynus*"; *page* 189, *line* 16 *from top*, *for* "timer" *read* "timber."

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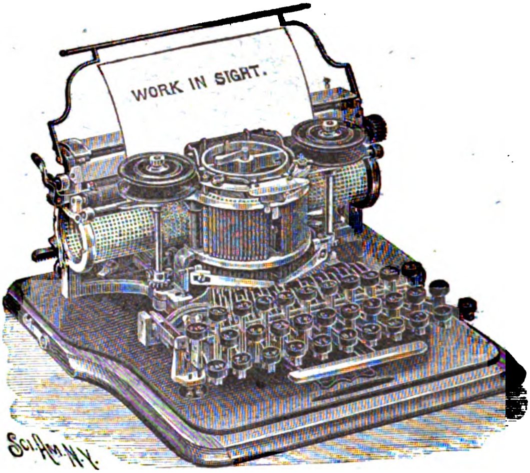
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EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary and Curator.

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THE

MAMMALS, REPTILES, AND FISHES OF ESSEX:

A CONTRIBUTION TO

The Natural History of the County.

(*Forming Volume* iii. *of the "Special Memoirs" of the Essex Field Club*).

BY

HENRY LAVER, M.R.C.S., F.L.S., F.S.A., etc.,

Of Colchester; Vice-President of the Essex Field Club, and Senior Surgeon
to the Essex and Colchester Hospital, Colchester.

WITH EIGHT FULL-PAGE AND TWO HALF-PAGE ILLUSTRATIONS.

THE Council of the Essex Field Club has pleasure in announcing that the above book is now published. The work forms Volume III. of the "Special Memoirs" of the Club, and is uniform with previous issues. Together with Mr. MILLER CHRISTY'S "Birds of Essex," issued in 1891 as Volume II. of the Club's "Special Memoirs," it affords a complete and valuable guide to the Vertebrate Fauna of the County of Essex.

The book extends to about 150 pages, and is illustrated by drawings of interesting species and their haunts in the County, by Major BALE, of Colchester, and Mr. H. A. COLE, of Buckhurst Hill.

Price - - 10s. 6d. nett.

London: SIMPKIN, MARSHALL & Co. (Limited).
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THE PRESIDENTIAL ADDRESS.

DELIVERED AT THE EIGHTEENTH ANNUAL MEETING ON MARCH 26TH, 1898.

By DAVID HOWARD, J.P., F.C.S. F.I.C.

"THE WORK OF THE ESSEX FIELD CLUB DURING THE PAST YEAR."

LADIES AND GENTLEMEN,—It is not always easy to find anything new and startling to say about those studies which are dear to members of the Essex Field Club, and perhaps it is well that it should be so, as one of the greatest dangers to real scientific progress is the fact that what strikes the attention of the outside public is the magnificence of the rewards of work and not the work itself. In science it is steady, patient work that bears fruit ; the public see the harvest, but did not see the tillage. Take as one example, the Röntgen rays, supposed by many to have been suddenly discovered by accident by Professor Röntgen. It was not so ; a more brilliant outcome of patient watching for results could not be found. There is another side of our work which is not without most valuable effects, and that is the study of Nature as a recreation and a rest. In the busy lives of most of us there is of necessity, endless worry and ceaseless activity, from which we sorely need some release. Where could we find it better than in the study of unchanging Nature around us ? Unchanging, I say, for even the most zealous believer in evolution asks for æons and æons for that evolution. In the infinitely small space of time in the generations of men, which seem so long to us, Nature was unchanging, and it is this which makes it such rest, among the changes of our lives, to turn to the contemplation and study of that which does not change. I believe that we cannot too highly value that side of our work, the curative effect of the study of natural history and Nature itself, as being just that repose from our busy lives which we all most need. As Lord Bacon said, " man was made in a garden," and in a garden we best find ourselves in those surroundings that are recreative in the highest sense. And surely we in Essex may rejoice that we have a garden of a larger size and more beautiful in character than is possessed by any prince or peer in the world. I cannot but regard Epping Forest as being, without exception, the most successful example of recreative Nature that could be found.

Yet though, as I have said, there is nothing very startling to call attention to, I would venture specially to urge upon our members the importance of the papers that had been laid before them in the past year. The papers cover a very wide range of work, which was all thorough. Those who have favoured the Club with papers and lectures have been able to call attention to the results of most excellent research in botany, zoology, geology, and archæology, and other kindred subjects. As we study the papers which were published in the ESSEX NATURALIST, all must be struck by the earnestness of them; everyone of them the fruit of long, hard, patient work. It is as trite a remark as is possible to make, that genius, after all, is, as the French so well put it, a long patience. If we take as a specimen the paper of Messrs. Kennard and Woodward's, "The Post-Pliocene Non-marine Mollusca of Essex,"[1] superficial people might say that was a small subject to study; but these small subjects require long patience, and such memoirs show the variety and minuteness of work that is needed in these days of modern science. If other papers on the list of those printed during the year were taken there would be found the same careful and thorough study, and each might serve to enable members of the club and all other students of natural history to realise how many subjects there are in which very much work may be done, not only by scientific men, but by those who have a little time to spare, who need recreation, and who are willing to devote themselves to the study of Nature, in some of these bye-paths of knowledge. We have another specially interesting paper, which was brought before us later on in the year, on the Entomostraca of Epping Forest, by Mr. Scourfield, which is an example of the sort of work that ought to be done far more than it is by those who love science for its own sake, and are willing thus to occupy spare time.

The life-histories of plants, the life-histories of the lower forms of life, require an infinity of working out; they need patience and minute study, but they are one of those fields of recreative intellectual work which is specially open to the naturalist. The collection of specimens is a very good thing, the study of other men's work is a very good thing, but if we could only find more enthusiasts who would carry on research, it would undoubtedly bear fruit to a far greater extent than would be imagined by a casual observer. It is the long and patient study of those minute variations, whether of plants or animals, the persistent observation of their development and growth, or it may be of some organisms, such as fungi, very low down in the scale of life, which ultimately bore fruit in important discoveries. And then as a reward of such work there is, from time to time, a sudden blossoming out of results of painstaking investigation. Perhaps the most brilliant example in biological science has been the sudden outburst of Bacteriology. Did that science suddenly arise? Was it by accident discovered that bacteria played a most important part in physiology? No, it was the outcome of minute investigation, and of patient microscopic work. It has struck me as an example of how imperfect the work of some very skilful men is, that we constantly find reference to hybridisation with little or no notice being taken as to which of the parent species bears the seed; and here again is a most promising opening for careful observation.

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[1] *Vide* ESSEX NATURALIST, Vol. X, pp. 87-109.

As to the lower forms of life, there is infinite field for labour there. Those who followed—as we all did with interest—Mr. Lister's investigations of the life-history of the Mycetozoa—and have followed a mass of slime developing into individuals, and the individuals suddenly reverting into a mass of formless slime, will have realised that there we have a problem of the obscurest character open to us.[2] Of the papers read I would specially call attention to the very interesting review—time only allowed it to be a very small corner of a great subject—that Professor Boulger brought before us, on Symbiosis. There we have again a problem of great practical importance. That certain small parasitic growths on the fibrous rootlets of papilionaceous plants should be a means of fertilizing the soil, that these recently unknown entities, these inconspicuous parasites, should solve a problem which had been of the greatest obscurity to scientific men, that of the origin of the nitrogenous constituents of soils—that by their action a vast proportion of the fertility of the fields was brought about, and yet so secretly that it was only in the last few years their presence and their work had been even guessed at, showed that there was nothing in Nature too small to be worthy of the patient study of scientific men.

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[2] See Mr. Lister's "Practical Hints on the Study of the Mycetozoa, with Note on the Epping Forest Species," ESSEX NATURALIST, Vol. X., pp. 23-27.

Then again there has been another side of our work which is exceedingly important. At the Club's pleasant meeting at Lady Warwick's seat at Easton, the protection of insects, mammals, and birds in danger of extermination, and of rare and common plants, was brought before us. That is a question upon which public opinion greatly needs education; and who could do it better than the various scientific field societies? We find that, as surely as any plant or insect, or, still more, a larger mammal or bird, excites the interest of the ignorant, it is almost certain to be exterminated. It was mentioned that not only was it done by accident, but even that zealous collectors, in order to raise the value of their own collections, had systematically exterminated rare insects and rare plants in order that others might not share in their good fortune in possessing specimens. This is undoubtedly one of those points upon which public opinion must be brought to bear. Then, again, with regard to rare birds. Of course, to the really zealous gamekeeper every bird that was not game was to be exterminated as soon as possible. It might eat an egg, although, maybe, nobody had known it to have done so, yet it must be killed for fear it should commit such a murderous crime. That is the only reason, I suppose, why anything unknown should be shot at—unless it is the instinct of the small boy, who threw stones at whatever he saw, developed and intensified in those old enough to know better.

Our excursion on to the Estuary of the Colne provided us with a charming picnic, and the historic satisfaction of knowing that we enjoyed those oysters which the Romans enjoyed nearly two thousand years ago—but not the same oysters. [Laughter.] At that meeting a most interesting paper was brought before us—that by Dr. Sorby on the preservation of natural history specimens. We learned that the obscure and little known chemical, formaldehyde, bids fair to render most valuable service to the zoologist. The old shrivelled mummy-like object that results from the use of alcohol gives place to a specimen of most marvellously natural appearance owing to this most curious preservative with which modern science has supplied us. The chemist did not intend to make a preservative when he discovered formaldehyde; it was only by accident he found out the practical use to naturalists and anatomists of what was to him, in the first instance, of merely scientific interest. Here again, we have an example of the importance of the useless. I believe more and more sincerely that the gravest danger that science has is the outcry for that which was immediately beneficial to industries or to human life or enjoyment. The cabbage held in front of the nose of the donkey, without which the donkey would not move, was surely not needed for the scientific man! It is an oft told tale—I have told it often enough, but I am afraid there is need for repetition—that the one thing we want in scientific study is to escape from the immediately useful. We should seek to understand and search out the secrets of Nature, and patiently allow time to prove their value to mankind.

Another part of the work of the Club I would venture merely to touch upon, and that is the *Museum work.* The success of the Epping Forest Museum has been most admirable. This success has been entirely owing to the fact that it was worked on sound lines. The mere putting together of specimens does not constitute a museum. The mere heaping together of curiosities might make an old curiosity shop, but does not constitute that which was worthy of the name or office of a museum; and I do feel that it is owing entirely, or in a very large measure, to the zeal and skill of our Secretary that the Epping Forest Museum is not only of most valuable assistance to the study of Epping Forest itself, but has also brought the question of museums most favourably to the notice of others, and is an example that will be followed in a good many other cases. With regard to our Central Museum, the whole matter is still *sub judice*, and I do not wish to speak too much upon it; but I do hope—knowing the great value of museums to students—that we may be able, when we have settled these difficult questions, which are being most carefully and patiently gone into, to make the collections of the Club, not merely a satisfaction to ourselves as collectors, but of great educational use to our neighbours, and permanently so to our naturalist friends. It is difficult to over-estimate the effects of a really good museum as a means of education. If we only excite the wonder and curiosity of a boy or girl, or of persons who might be thinking themselves learned, but who had never progressed beyond the boy or girl stage of thought—if we can call into action that instinctive inclination to ask why a thing is, and to ask that question really intelligently—we shall have educed the true scientific spirit, and we shall not have laboured in vain.

I do not know that I need say more about the work of the year, except to say that as we remember the past, and look forward to the future, the good work of the past ought to be a constant stimulant to us to emulate, and to surpass it, and and to take care that in the future even more than in the past the Essex Field Club should show itself worthy of its opportunities – worthy of its charge of the study of natural history in one of the most interesting counties in England.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR ENDED DECEMBER 31st, 1897.

[Read and adopted at the 18th Annual Meeting held at Stratford, March 26th, 1898.]

AS it is understood that the President will take as the subject-matter of his Address, the work of the Club during the past year, there is less need for a greatly extended report from the Council.

Financial.—The General Account for the year 1897 shows that the debit balance brought down has been reduced from 72*l* 7*s*. 5*d*. to 44*l* 2*s*. 1*d*.; and, in addition to this, it should be noted that, under a resolution of the Council passed on October 16th, 1896, all the year's expenses are included in the year's accounts.

The subscriptions in arrear on January 1st, 1898, amounted to about 25*l*., one-half of which has since been received. The apparent falling-off in the total amount of the subscriptions, as compared with 1896, is due to a circumstance noted in the last report, viz., that in that year's account a large amount of old arrears was included.

The debit balances on the Special Memoirs and the Central Museum Accounts have been reduced in each case by a few shillings; but the overdraught in the case of the Forest Museum Account has been nearly doubled.

The Life Composition Account has experienced the benefit of the measures foreshadowed in the last report, and will, it is anticipated, benefit still further during the current year.

Many members have availed themselves of the facilities afforded by a use of the Bank-order forms supplied by the Club, and it is thought that, as time goes on, still more will find it desirable to adopt this eminently simple and satisfactory method of paying their subscriptions.

During the year the Club has had cause to regret the loss, by death, of two Life Members—Messrs. Griffiths Smith, and J. W. Dunning; and of two Ordinary Members—Messrs. T. J. Mann and Thomas Jackson. The losses by resignation amounted to sixteen, but these were more than counterbalanced by the election of forty new members. The numerical strength of the Club on December 31st was as follows:—Life Members, 28; Ordinary Members, 220; Ordinary Members (1893), 33; Honorary and Exempt Members, 21; making a total of 302. There are also six subscribers to the Forest Museum, who are not members of the Club.

Meetings.—The Field Meetings have been exceptionally well attended. A very successful meeting was that held on July 21st at Bishop's Stortford and Easton Lodge, near Dunmow, when a discussion took place on the protection of our native animals and plants. On this occasion the Club was most hospitably received by the Countess of Warwick, who did all in her power to render the visit to Easton Lodge pleasant and interesting. Mr. Marshall Taylor also most kindly received the party at Bishop's Stortford. Another notable meeting was that held in the Colne Estuary on September 9th, and the Council wish specially to record the thanks of the Club to the Colne Fisheries Board for the facilities afforded in inspecting the oyster feeding grounds and to Mr. Shenstone and Mr. Benham for aid rendered in the conduct of the meeting. The Annual Fungus Meeting was held on October 16th at Warren Hill House, on the invitation of Mr. and Mrs. S. H. Johnson who received and entertained the Club in the kindest way. The institution of the Annual Supper on December 11th proved a success, and the Council anticipate that the fixture will be very popular with the members as it becomes better known. In connection with the various meetings held during the year, the Council have great pleasure in acknowledging valuable aid rendered by the following gentlemen:—Mr. E. D. Marquand, Mr. T. V. Holmes, F.G.S., the Rev. R. C. M. Rous, Mr. F. Hughes, F.C.S., Professor Boulger, F.L.S., Mr. S. A. Sewell, F.R.H.S., Mr. G. E. Pritchet, F.S.A., Mr. J. L. Glasscock, Mr. C. G. Barrett, F.E.S., Professor Meldola, F.R.S. Mr. W. Whittaker, F.R.S., Mr. J. E. Harting, F.L.S., Dr. H. C. Sorby, F.R.S., Mr. J. C. Shenstone, Mr. C. E. Benham, Mr. E. A. Fitch, F.L.S., Mr. Edgar Newman, Mr. W. M. Webb, F.L.S., Mr. R. O. Coombs Messrs. Forrest and Sons, Dr. M. C. Cooke, A.L.S., Mr. E. M. Holmes, F.L.S., and Mr. G. Massey, F.L.S.

The number of meetings held was ten; the interest at all of them was well maintained, but it is a matter for regret that members do not more generally exhibit specimens at the meetings; exhibits and remarks on the same are always welcomed, and they often tend to elicit interesting information and to promote useful discussion.

The Club is again indebted to Mr. H. A. Cole for drawings used in illustrating the circulars and reports of the Field Meetings.

Publications.—Four parts of the ESSEX NATURALIST were published within the year 1897, comprising with Title and Index to Volume IX, 236 pages. With the first part of Vol. X., which was published in April, the work of the new printer, Mr. Dutton, of Chelmsford, commenced, and the Council are well satisfied with the manner in which the Journal has been produced; while at the same time, the cost of production has been lessened. It is the constant care of the Council and the Editor to preserve the *local* character of the Journal, but the importance of a comprehensive study of natural history is not lost sight of, the E.N. not being allowed to become a mere

TREASURER'S STATEMENT OF INCOME AND EXPENDITURE—1897.

GENERAL ACCOUNT.

Dr.	£	s.	d.	£	s.	d.
To Subscriptions, 1893		15	0			
,, ,, 1894		15	0			
,, ,, 1895	1	10	0			
,, ,, 1896	12	10	6			
,, ,, 1897	152	12	6			
,, ,, 1898	3	0	0			
				171	9	0
,, Entrance Fees				1	11	6
,, Sale of Museum Guides					9	5
,, Subscriptions to Forest Museum 1896	1	1	0			
(Maintenance) Fund 1897	8	12	0			
				9	13	0
,, Donation (Mr. T. V. Holmes)				3	5	0
,, Bonus on Septennial Fire Policy					15	0
,, Commission refunded					10	6
,, Transferred from Life-Composition Account ..				10	10	0
,, Balance (Excess of Payments over Receipts) ..				44	2	1
				£242	5	6

Cr.	£	s.	d.	£	s.	d.
By Balance from 1896 (Excess of Payments over Receipts)				72	7	5
,, Printing and illustrating Essex Naturalist (3 parts)				56	19	5
,, Printing Circulars, &c.; and Stationery ..				18	0	6
,, Postage of Essex Naturalist and Circulars; Officers' Correspondence, etc. ..				18	9	4
,, General and Incidental Expenses				11	4	4
,, Central Museum (Maintenance):—						
Rent of Building	25	0	0			
,, ,, Cottage	2	11	9			
Salary of Sub-Curator (Mr. Mothersole)	9	7	0			
Fire Insurance	2	0	0			
Incidental Expenses	2	8	6			
				41	7	3
,, Forest Museum (Maintenance):—						
Incidental Expenses..	9	11	5			
Fire Insurance		13	6			
				10	4	11
,, Library Expenses: Books, etc.				4	18	6
,, Lecturers' Fees				5	5	0
,, Hire of Room					4	0
,, Loss on Field Meetings				3	4	10
				£242	5	6

SPECIAL MEMOIRS AND PUBLICATIONS ACCOUNT.

Dr.	£	s.	d.	£	s.	d.
To Special Memoirs		9	2			
,, Essex Naturalist		14	0			
				1	3	2
,, Balance (Excess of Payments over Receipts)				23	15	7
				£24	18	9

Cr.	£	s.	d.
By Balance from 1896 (Excess of Payments over Receipts)	24	18	9
	£24	18	9

		£ s. d.			£ s. d.
To Donations 1897		6 0 6	By Balance from 1896 (Excess of Payments over Receipts)		9 13 2
„ Balance (Excess of Payments over Receipts) ..		8 8 2	„ Half cost of final Instalment on Typewriter ..		3 12 6
			„ Fittings		1 3 0
		£14 8 8			£14 8 8

FOREST MUSEUM FUND.

		£ s. d.			£ s. d.
To Balance (Excess of Payments over Receipts) ..		9 15 0	By Balance from 1896 (Excess of Payments over Receipts)		5 7 0
			„ Half cost of final Instalment on Typewriter ..		3 12 6
			„ Fittings		15 6
		£9 15 0			£9 15 0

LIFE COMPOSITION ACCOUNT.

		£ s. d.			£ s. d.
By Balance from 1896		115 0 6	To Amount transferred to General Account :—		
			Mr. Griffiths Smith (Deceased) ..	5 5 0	
			Mr. J. W. Dunning (Deceased) ..	5 5 0	
					10 10 0
			„ Balance to 1898		104 10 6
		£115 0 6			£115 0 6

LIFE COMPOSITION RENEWAL FUND.

		£ s. d.			£ s. d.
By amt. allocated, March 2, 1897		10 0 0	To Balance carried to 1898 Account		10 14 0
„ Sale of Publications		14 0			
		£10 14 0			£10 14 0

FINANCIAL SUMMARY.

		£ s. d.			£ s. d.
To Life Composition as above	104 10 6		By Cash at Banker's (Current Account) Dec. 31st, 1897		7 14 4
„ Cash in Bank, as *per* Renewal Account (Deduction)	10 14 0		„ Cash in the hands of Hon. Secretary		1 4
		93 16 6	„ General Account		44 2 1
			„ Publications		23 15 7
			„ Central Museum		8 8 2
			„ Forest Museum		9 15 0
		£93 16 6			£93 16 6

N.B. It should be noted that the Club possesses large assets in Books, Cabinets, Specimens, Stock of Publications, etc., which, although valuable, cannot easily be estimated in money.

Examined with the Vouchers this 22nd day of February, 1898, and found correct.

WALTER CROUCH. }
JOHN D. COOPER. } Hon. Auditors.

record of parish distribution of animals and plants. It is satisfactory to note that in the "Index of the more important Papers, and especially those referring to Local Scientific Investigation, published by the Corresponding Societies of the British Association during the year ending June 1st, 1897," given in the Reports of the British Association for 1897, the ESSEX NATURALIST is quoted for 24 papers relating to local observation in our County.

The Editor renews his request for notes and early intimation of any events or phenomena worthy of being recorded in the E.N. He has to thank Mr. T. Hay Wilson for kindly sending the *Field* as published, and the proprietors of the *Essex County Standard* for copies of their paper, regularly sent.

Memoirs contributed.—As stated above, it is believed that the President intends dwelling somewhat fully in his Address on the work of the Club, including the papers contributed. The Council may be permitted to allude to several of the essays read at the meetings or communicated direct to the Editor, and which have been published in the ESSEX NATURALIST during the past year. Not only is the number of papers considerable, but the Council would particularly call attention to the permanent value of the faunistic papers communicated by Messrs. Kennard and Woodward (viz., "The Post-Pliocene Non-Marine Mollusca of Essex" and "The Post-Pliocene Mollusca of Felstead"); of Mr. Webb's careful enumeration of the Non-Marine Mollusca of Essex; and of Mr. Scourfield's papers on "The Entomostraca of Epping Forest," the publication of which will be commenced in the forthcoming part of the ESSEX NATURALIST. The accurate ascertainment of the precise limits of the Fauna and Flora of a district by competent observers is a most useful function of Local Societies, and the Essex Field Club may fairly claim that during the past 18 years it has been doing its share of this tediou and difficult but most necessary work.

Papers such as Mr. Lister's on the "Mycetozoa," Mr. Marquand's on the "Algæ," and Dr. Sorby's on the "Marine fauna of our coast," are esteemed highly as pointing out the direction of good work which might well engage the attention of our younger members.

At the "Fungus Foray" on October 16th last, occasion was taken by those present at that large meeting, at the suggestion of Professor R. Meldola, F.R.S., and Mr. G. Massee, F.L.S., to pass a special vote of thanks to Dr. M. C. Cooke, for the active share he had taken in promoting the accurate study of Fungi during her Majesty's reign and "in particular for the very valuable services Dr. Cooke had rendered to science and to popular education by the number and excellence of the works he had written on the Cryptogamia, and also for the assistance he had always been so ready to afford to beginners and earnest students." The Council wish to endorse and emphasise this appreciative vote of thanks; and also to gratefully acknowledge the Club's indebtedness to Dr. Cooke for the aid he has rendered to the Society in the capacity of principal "Conductor" and Recorder at the Fungus Meetings. Dr. Cooke conducted the first "Fungus Foray" on October 2nd, 1880, and ever since he has been the leading spirit at these meetings. The value of his catalogues of the forest species of Fungi published from time to time in our Journal has been very widely recognised by botanists. The Council heartily joins in the hope expressed by the members and the numerous field-botanists present at the meeting mentioned above, that the Doctor may be spared to carry on his good work and to assist at these gatherings for many years to come.

"The Mammals, Reptiles, and Fishes of Essex." -The final arrangements with Dr. Laver for the publication of this book as one of the "Special Memoirs" series were completed during the year. The Agreement with the author provides that the publishing price should be 10*s*. 6*d*. nett; that the subscription price to the general public should be 7*s*. 6*d*. and the subscription price to the members of the Club 6*s*. The Club has subscribed for 50 copies at 6*s*. (£15), such copies not to be sold until the expiration of six months from the date of publication, and then only to members of the Club, but it has been agreed that this prohibition shall not apply to the sale of sets of the Club's publications to non-members. The Council have pleasure in acknowledging the kindness of the President, Mr. Howard, who has promised to contribute £5 towards the cost of the 50 copies subscribed for by the Club as above.

The book was published on March 7th. The list shows that members of the Club have subscribed for 119 copies, a result which may be considered satisfactory. The Council have to thank Dr. Laver for the care he has taken in the production of the volume, which cannot fail to be of great value to Essex Naturalists, and which will, it is hoped, be an encouragement and help in the further study of our county animals.

In connection with the publication of this book the Council have reduced the price, *to members*, of the *Birds of Essex* to 7*s*. 6*d*.; the two volumes form a complete guide to the vertebrate fauna of Essex. The special value of such works is that they emphasise the deficiencies in our knowledge. For instance, Dr. Laver's list of 113 Fishes hitherto satisfactorily determined as inhabitants of the rivers and sea-board of Essex is probably far too small, bearing in mind how much remains to be discovered with regard to the marine fishes; good work might be done by those living near the coast or spending their holidays there, in the investigation of this interesting and extremely important class of animals, and the Council strongly recommend the subject to the attention of members having opportunities for observation.

The Club's Local (County) Museum.—Very important developments have taken place with regard to the Club's County Museum. The conditions under which an offer was made to the Corporation of Chelmsford, together with a statement of the position of affairs were fully set out in the last Annual Report (ESSEX NATURALIST Vol. X., pp. 18-20). It will be sufficient to say on the present occasion that the Club's offer was not accepted by the Corporation of Chelmsford. The Council then made precisely the same offer to the Corporation of West Ham, and this offer was accepted by that Corporation, and Mr. Passmore Edwards has generously offered to contribute a sum of £2,500 towards the cost of building a suitable Museum to contain the Club's Collections, adjoining the Technical Institute in West Ham, on condition that the Corporation maintains the building for that purpose. The Corporation of West Ham have accepted Mr. Edward's offer, and the proposed Agreement between the Corporation and the Club is now being drafted. The main conditions are (A) On the part of the Corporation: To dedicate the building to the purposes of a Museum of Local (Essex) Natural History and Archæology; to warm, light, and provide for the care-taking of the same; to engage that the Club shall have the sole scientific control of the Collections, and the appointment of the Curator, and be allowed to keep its Library in the building; and to make a grant of not less than £100 per annum towards the Curatorial expenses. (B) The Club, on its part, will undertake to place its County Collections, Cases, and Cabinets in the Museum; to do its best to increase and improve them; to do its best to raise a suitable sum for the purchase of cases and specimens; to appoint a Curator, and to devote a sum of £50 per annum towards the Curatorial expenses. It is unnecessary to say that if the above plans are adopted the Museum and Library will be firmly established, and the Club will be enabled to carry on this important work freed from the cares and embarrassments which have been so hurtful of late years.

At the present time the Council simply report the above to the members. Negociations of more than one kind are now pending, but a full statement will be made shortly, and the Club will be asked to come to a decision on the matter.

The Epping Forest Museum.—The Museum has been carried on very successfully during the past year, and the average attendance was well maintained. Many of the visitors appear to take an intelligent interest in the Museum; they come time after time, evidently with the intention of gaining a better acquaintance with the collections exhibited. The repeated visits of schoolboys from the neighbourhood are to be recorded with satisfaction; the Curator has noticed the same boys again and again, who brought their companions, and explained the specimens which had attracted their notice. Many schools have also attended, as was the case during the previous years, and the Curator has, on several occasions, been present by request at these visits to give short expositions of some of the Collections to the pupils. Again, one very gratifying feature of the year's work was the total absence of injury to the specimens or cases, and this, in spite of the fact that the Museum was open on the Bank Holidays, and on these days was thronged with all classes of visitors.

Pending the possession of more space in the Museum, but little could be advantageously done in adding to or re-arranging the collections. But the collections have been carefully attended to and improved from time to time, and in particular a series showing the peculiarities of the Forest Deer and the characters of the Red Deer and Roe Deer has been set up. The Committee have to thank Mr. Tower and the Rev. J. Whittaker Maitland for the gift and loan of specimens employed in making up the set. Mr. Maitland has also lent for exhibition a specimen of the Bittern reputed to be the last specimen of this bird killed on the Forest. In the preparation of these and other series, the Typewriter purchased towards the end of 1896 has been of essential service.

Mr. J. A. Clark has removed his specimens of birds, which he so kindly lent for a period of more than 18 months. He has expressed himself quite satisfied with the care taken of them while in the Museum. Mr. Clark has been warmly thanked by the Committee for his valuable aid.

The Committee are sorry to say that Mr. J. Hay Wilson, whose services have been so useful in gathering together of forest geological and petrological specimens, has left the forest district, but the Committee hope that Mr. Wilson's assistance in this department will not cease with his change of residence.

The Committee may be pardoned in expressing their pleasure in knowing that it was largely through the favourable impression produced by the inspection of the Museum by the members of the Technical and Library Committee of the Corporation of West Ham, that the Corporation agreed to the Club's proposals with respect to the County Museum. The Technical Instruction Committee visited the Museum in force on October 19th last, and were met by the President and the Curator.

The Committee have to thank Mrs. Butt for the care she has bestowed on the Museum during the past year.

In the previous report the Committee stated that efforts were being made to obtain more space in the Museum, and that the Epping Forest Committee of the Corporation of London had been approached with this object in view. Judging from the two last Reports of the Epping Forest Committee, it seems probable that the whole question of the repair of the Queen Elizabeth's Lodge and the apportionment of more space for the Museum will be taken in hand by the Corporation. But while being hopeful on this subject, it would be manifestly useless for the Committee to speculate on what may or may not be done, and we can only patiently await the outcome of our application.

The Committee think that the Club is fully justified in considering the experiment a successful one, but the Museum that stands still goes back, and it is heartily to be wished that the Curator could be put into such a position as would enable him without long delay to carry forward the good work we have commenced. The forest district teems with life and with interesting and instructive objects which should be illustrated in the Museum. What is really wanted is systematic collecting, carried on with a definite object in view, and with ample means of procuring bottles, boxes, cases, &c., &c., and for securing skilled assistance in preserving the larger and more difficult specimens.

Reference may be made to Dr. Cooke's paper "On the Essex Fungi, and how they should be represented in the Museum" as giving details from the botanical side, of the methods of exhibition that might advantageously be adopted in the Museum did space and funds permit.

The Committee venture to hope that with the brighter days that seem looming in the distance for the Club's Museums, that the members and the general public will afford the necessary aid with some generosity and freedom.

President.—The Council have great pleasure in proposing Mr. Howard for re-election as President.

THE ESSEX FIELD CLUB.

SPECIAL MEETING.

SATURDAY, JANUARY, 22ND, 1898.

AT the Loughton Public Hall, a Special Meeting was called by the Council for the purpose of proposing for the adoption by the Members (under the powers of Rule XXXVII.) certain alterations in the Rules, rendered necessary by the projected establishment of the Club's County Museum and Library at Stratford.

Mr. David Howard, President, took the chair at six o'clock.

The Hon. Secretary read the notice calling the meeting.

The President shortly detailed the condition of affairs with reference to the Club's County Museum, and the efforts which had been made by the Club to establish it at Chelmsford. These efforts had wholly failed, but an offer had come from the Borough of West Ham which the Council strongly recommended the Club to accept. Mr. Howard explained the scheme and concluded by moving :—

"That in Rule XXV. the word '*Chelmsford*' be struck out, and the word '*Essex*' be inserted in its place."

Mr. F. H. Varley seconded the resolution. He was sure that after years of strenuous efforts, it was most desirable to have the Museum in a place where they could get real, active, support and co-operation, and where funds would be found to maintain the institution in a practical working condition.

Mr. F. Chancellor, who had sent a circular letter to the members a day before the meeting, strongly opposed the removal of the Museum from Chelmsford.

Mr. Durrant also strongly opposed.

Mr. W. Cole emphatically denied the truth of a great many of the allegations made by Mr. Chancellor in his circular letter.

A very long discussion ensued, carried on by Mr. Carruthers Gould, Mr. Robinson, Mr. Chancellor, the President, Mr. Durrant, Mr. W. C. Waller, Mr. C. Williams, and others.

Ultimately a proposal was made to form a Committee for the purpose of determining what portion of the exhibits in the Essex Field Club's Museum at Chelmsford formerly belonged to the old Essex and Chelmsford Museum Society before its amalgamation with the Club as from the 1st January, 1893, and the apportionment of the pecuniary liabilities attaching to the same. The resolution met with the approval of the majority of the members present at the meeting, and the members of the Council were constituted the Committee. As, however, the proposition was carried as an amendment to the first resolution on the agenda paper, no advance could be made in the business of the meeting.

SPECIAL MEETING AND 176th ORDINARY MEETING.

SATURDAY, FEBRUARY 26TH, 1898.

A SPECIAL MEETING and the 176TH ORDINARY MEETING were held in the rooms of the Young Men's Christian Association, West Ham Lane, Stratford, at 5.30 p.m., Mr. David Howard, F.I.C., &c., President, in the chair.

The President said that the business of the SPECIAL MEETING was to propose for the acceptance of the members the following alterations in the Rules, which the Council had agreed should be brought to the vote :—

"That, having in view the geographical distribution of the railway system of the County of Essex, and the disadvantages with regard to meetings held off the main line under which, perhaps, one-fourth of the Members of the Essex Field Club are placed, the Council recommend the omission in Rule XVI. of the words 'but no official (Ordinary) meetings at which minutes of former meetings are read and confirmed (other than meetings of Council and Committee specially appointed by the Council) shall be held outside the boundaries of the County of Essex'; and in Rule XXXVII., line 3, of the words 'held in the County of Essex.'"

The President explained it was not anticipated that necessity would often arise for calling a meeting out of Essex, but such might occur, as it was difficult to fix upon any place in Essex which was as convenient to all members as *London*. It was important that the Council should have the power of calling any very important meeting at a place where the majority of the members would attend. He, therefore, moved on behalf of the Council that the Rules should be altered as above set forth.

Mr. Cecil Schwartz seconded the proposal, which was *carried unanimously*.

This concluded the business of the Special Meeting.

The 176TH ORDINARY MEETING was then held.

The following were elected members of the Club:—Mr. Arthur Boake, F.C.S., Miss M. Blanche Cuthbertson, and Miss Kate Kimble.

Nominations of new members of Council and Officers were made in accordance with the Rules, in anticipation of the Annual Meeting to be held on March 26th (see Report of Annual Meeting). No other nominations were made.

The Secretary read on behalf of the authors, a short paper entitled "Notes on a M.S. of the late John Brown, F.G.S., of Stanway," By Messrs. A. S. Kennard, and B. B. Woodward, F.L.S., F.G.S. This paper will appear in the ESSEX NATURALIST.

Remarks on the paper were made by the President and Mr. W. Cole and a vote of thanks was passed to the authors.

Mr. J. Avery said that in one of the county papers there was a paragraph to the effect that a rare Essex map by Col. Mudge had been hung in the Shire Hall. He asked if anyone could tell him whether the map alluded to was the one published in 1826 by Mr. Greenwood. He was under the impression that Greenwood's map was surveyed by Mudge.

Mr. Walter Crouch said that Mudge's Map was not so rare as was supposed, but it was more correct than any of the earlier maps. [1]

Mr. W. C. Waller thought that it would be very interesting if a list of Essex Maps could be produced.

THE EIGHTEENTH ANNUAL GENERAL MEETING AND 177th ORDINARY MEETING.

SATURDAY, MARCH 26TH 1898.

THE 18TH ANNUAL GENERAL MEETING of the Club was held at the Young Men's Christian Association, Stratford, at 6.30 o'clock, Mr. David Howard, J.P., F.C.S., President, in the chair.

Previous to the Annual Meeting, an Ordinary Meeting (the 177th) was held.

Mr. J. E. Harting, F.L.S. (one of the Hon. Members) and Mr. William Taylor, were elected members of the Club.

County Museum. Mr. Waller, the Hon. Secretary of the Sub-Committee, reported as follows with respect to the enquiry referred to the Council as a Committee by the resolution of the Special Meeting on January 22nd last;—

"The Council beg to report that they delegated the enquiry to a sub-committee, consisting of the Rev. R. E. Bartlett, Mr. T. V Holmes, and Professor Meldola, with instructions to report to a Council Meeting to be held not less than ten days prior to the Annual Meeting in March. The Sub-Committee having found it impossible, from various causes, to comply with this condition, have applied for and been granted an extension of time. Their report, however, is understood to be now nearly complete, and a Council meeting will shortly be summoned to receive and consider it, with a view to bringing the matter later on before a Special Meeting of the Club."

Mr. Avery exhibited a copy of a rare map of Essex—Saxton's map—dated 1576, supposed to be the earliest known map of the County.

The 18th ANNUAL GENERAL MEETING was then held:—

THE minutes of the 17th Annual Meeting held on March 27th, 1897, and printed in the ESSEX NATURALIST, Vol. X., pp. 13-16, were read and confirmed.

The Treasurer's Statement of Accounts for 1897, duly signed by the Auditors Messrs. Walter Crouch, and J. D. Cooper, was read by Mr. Waller, together with a short report of the same (see pp. 248-9).

The Report of the Council for the year 1897 was read by the Secretary (see page pp. 246-53).

The Statement and Report were received and adopted.

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[1] See Mr. Crouch's account of Mudge's Map in "Notes Original and Selected."

At the meeting on February 26th, it was announced that the following members retired from the Council in rotation in accordance with the Rules: Rev. R. E. Bartlett, Mr. E. N. Buxton, Lord Rayleigh, and Dr. Thresh.

At same meeting, the following members were duly proposed and seconded for ELECTION into the COUNCIL :—

Rev. R. E. Bartlett, M.A.; Mr. E. N. Buxton, J.P., D.L. (*Verderer of Epping Forest*); Mr. J. E. Harting, F.L.S., F.Z.S. (*Assistant-Secretary to the Linnean Society*); Rev. A. F. Russell, M.A (*Chairman, Epping Forest Museum Committee*).

As OFFICERS for 1898 the following were nominated :—

As *President*, Mr. David Howard, J.P., F.C.S., ; *Treasurer*, Mr. W. C. Waller, M.A., F.S.A.; *Hon. Secretary and Curator*, Mr. W. Cole, F.L.S., F.E.S.; *Assistant-Hon. Secretary*, Mr. B. G. Cole; *Librarians*, Mr. E Durrant and Mr. W. C. Waller, M.A, F.S.A, *Hon. Counsel*, Mr. W. C. Dare, B A., Barrister-at-Law; *Hon Solicitor*, Mr. H. I. Coburn.

As *Auditor* (*for Council*), Mr. Walter Crouch, F.Z.S.; (*For Members*), Mr. J. D. Cooper.

No other members having been proposed, the above gentlemen stood elected by Rule VII. as members of the Council and Officers for the year 1898 and were so declared by the Chairman.

[The following therefore constitute the Officers and Council for 1898 :—

PATRON.—H.R.H. the Duke of Connaught and Strathearn, K.G.

PRESIDENT.—David Howard, J.P, F.C.S., F.I.C.

PERMANENT VICE-PRESIDENTS.—(*Under Rule IV.*)—Prof. R. Meldola, F.R.S., F.R.A.S., &c., *President* (1880-82); Prof. G. S. Boulger, F.L.S., F.G.S. (*President* 1883-84); T. V. Holmes, F.G.S., M.A.I. (*President* 1885-87); E. A. Fitch, F.L.S., F.E.S (*President* 1888-91); Dr. Henry Laver, F.L.S., F.S.A. (*President* 1892); Frederic Chancellor, J.P., F.R.I.B.A. *President* (1893-94).

OTHER MEMBERS OF COUNCIL.—John Avery, C.A., Rev. R. E. Bartlett, M.A.; C. E. Benham; Horace T. Brown, F.R.S.; E. N. Buxton, J.P., Aldmn. C.C., D.L., &c.; Miller Christy, F.L.S.; Walter Crouch, F.Z.S.; Bryan Corcoran; L. Cranmer-Byng; F. W. Elliott; A. J. Furbank; I. Chalkley Gould; J. E. Harting, F.L.S., F.Z.S.; Rev. W. C. Howell, M.A.; Andrew Johnston, Chm. C.C., J.P., &c.; Rev. W. S. Lach-Szyrma, M.A.; Alfred Lockyer; J. H. Porter; Rev. A. F. Russell, M.A.; J. C. Shenstone; John Spiller, F.I.C., F.C.S.; F. H. Varley, F R.A.S.; George E. Vaughan; T. Hay Wilson.

HON. TREASURER.—W. C. Waller, M.A., F.S.A.

HON. SECRETARY AND CURATOR.—William Cole, F.L.S., F.E.S., ; ASSIST. HON. SECRETARY.—B. G. Cole.

HON. LIBRARIANS.—Edmund Durrant and W. C. Waller.

HON. COUNSEL—W. C. Dare, B.A, Barrister-at-Law; HON. SOLICITOR.—H. I. Coburn.]

Mr. Cole presented the account of receipts and expenditure of the Tea Fund during the year. This was a voluntary subscription to provide light refreshments at the close of the meetings.

In accordance with the powers conferred on him by Rule III. the President nominated the following four members of the Council to act as VICE-PRESIDENTS during his year of office:—Mr. E. N. Buxton, Mr. Walter Crouch, Mr. J. Chalkley Gould, and Mr. J. C. Shenstone.

Mr. Howard then delivered his ANNUAL PRESIDENTIAL ADDRESS, which was mainly devoted to the consideration of:

"THE WORK OF THE ESSEX FIELD CLUB OF THE PAST YEAR."

[The Address is printed in the present part of the E.N., see pp. 241-46].

Mr. Walter Crouch proposed that a cordial vote of thanks should be passed to the President not only for his work during the past year, but also for the admirable address to which they had listened. There was much to stimulate thought in his address, which he hoped would induce good work being done in the future in the studies of our local naturalists.

Mr. J. H. Porter had much pleasure in seconding the vote of thanks, which was carried amid applause.

Mr. Howard thanked the members for their reception of his address. With regard to himself he would only say that he would do all in his power to forward the good work of the Club in the future.

Mr. S. A. Sewell, in an eulogistic speech, proposed that the thanks of the Club should be given to the officers for the admirable way in which the work of the Club had been carried on during the past year.

Mr. Fountain cordially seconded the vote which was put by the Chairman with a few remarks emphasizing that which had fell from the previous speakers, and carried unanimously.

Mr. W. C. Waller replied on behalf of himself and his colleagues, and the meeting ended, tea and coffee being served as usual.

THE ENTOMOSTRACA OF EPPING FOREST, WITH SOME GENERAL REMARKS ON THE GROUP.

(*Continued from page* 210.)

By D. J. SCOURFIELD.

[*Read November 27th, 1897*].

PART II.

CHIEF RESULTS OF WORK ON THE ENTOMOSTRACA OF EPPING FOREST.[1]

IN a paper published in the *Journal of the Quekett Microscopical Club* in 1893 (82),[2] some particulars have already been given of the Entomostraca of the little piece of Epping Forest known as Wanstead Park. It is now proposed to expand that account so as to include the whole of the Epping Forest district. To prevent misunderstanding it should be stated at once that by the latter term is meant not only the actual Forest under the management of the Epping Forest Conservators, but also a certain margin on both sides of this, extending to the Lea on the west and to the Roding on the east. The district agrees in fact with that defined by Mr. W. Cole in his paper on "The area of Epping Forest for Faunistic Purposes." (ESSEX NATURALIST Vol. VI. (1892) p. 10), but with this exception, that the large triangular tract of country to the north-west of Cobbins' Brook is not included. The area of the district thus limited is about 35,000 acres, but it is only fair to state that the bulk of the collections have been made in the 5,600 acres or thereabouts preserved to the public.

Although the literature dealing with the fauna of Epping Forest is fairly extensive, very little has hitherto been published on the Entomostraca. The following are the only sources of information known to me. The lists of objects found on the excursions of the Quekett Microscopical Club published in the *Journal* of that Society from 1889 onwards (57), have included many species from ponds within the Epping Forest area. In January, 1892, a note on the males of the Cladocera was published in *Science Gossip* (80), and later in the same year, in a paper on "Some new records of British Cladocera" (81), six species were added to the then known British fauna, all of which were from the district under consideration. Lastly, the paper already alluded to, on the Entomostraca of Wanstead Park (82), issued in 1893, gave a list of sixty species, together with some notes on seasonal distribution, &c.

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[1] Part I., "Some General Remarks on Entomostraca" is printed *ante* pp. 193-210; Part III., "A detailed list of the Epping Forest species;" and Part IV., "A Bibliography of the Literature relating to the British Fresh-water Entomostraca" will be published in succeeding parts of the ESSEX NATURALIST. [ED.]

[2] The figures in brackets refer to the numbers of the papers in the Bibliography appended (See Part IV.)

Before entering into the discussion of the actual results obtained, just one other point must be mentioned. It has been stated above that the present paper is to be regarded as an expansion of the one on the Entomostraca of Wanstead Park. It must not be supposed, however, that the basis of collected facts is quite the same in each case. In the records from Wanstead Park an attempt, a very rough one it is true, was made to collect systematically. The records from the remaining parts of the Forest district, on the other hand, have been made almost at random. The only pre-arranged plan, if it is worthy of the name, has been to get collections from as many different stations as possible, and as often as opportunity allowed. The result of this is that, whilst the list of species shows a very marked increase upon the Wanstead Park record, the facts concerning periodicity and some other matters cannot be strictly compared in the two cases. Further allusion will be made to this subject in connection with the seasonal distribution of the species.

I propose now, following the plan of the earlier paper, to make a few remarks on the chief results of the study of the Epping Forest Entomostraca, and then to give some detailed notes upon all the species observed. (See Part III.)

Total number of species recorded.

From the list given in Table I., it will be seen that the total number of species recorded has been 102, comprising Cladocera 47, Branchiura 1, Ostracoda 22, and Copepoda 32. This is an increase of 42 upon the Wanstead Park list of 1892, and of more than 20 upon the total published records from the whole district to date. Taken as a whole, the present is, I believe, the most

,, *lactea* ..	..	..	..		..	+	+	..	..	+	..	+	..	4	3		..	..	..	..	..		..	+	..	..	+	..	..	..	..
,, *compressa*	.	..	+	+	..	..	..	..	..	..	..	+	..	3	1		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,, *pubescens*	..	+	+	+	+	+	+	+	+	+	+	..	+	20	4		+	+	+	+	..	+	..	..	..	..	..	..	..	..	..
,, *fabaeformis*	..	+	+	+	+	+	..	..	..	+	+	+	..	18	7		+	+	+	..	..	+	..	..	+	..	+	..	+	..	..
Limnicythere inopinata	..	.	.	.	..	+	+	..	..	+	+	..	..	9	3		..	..		..	..	..	+	..	+	..	..	..	..	..	..
COPEPODA—																															
Diaptomus castor	..	+	+	+	+	+	+	..	..	+	+	+	+	21	9		..		..	..	+	+	..	..	..	..	..		+	..	..
,, *gracilis*	..	+	+	+	+	+	+	+	+	+	+	+	+	138	19		+	+	+	+	+	+	..	+	+	+	+	+	+	+	+
,, *vulgaris*	..	..	..	..	..	..		..	..	..	+	..	..	2	1		..	+	..	..	..	+	..	..	..	..	..	..	..	..	..
Eurytemora lacinulata	..	..	.		..	+	+	+	..	..	..	+	..	7	1		..	..	.	..	..	..	..	..	..	..	+	..	..	..	..
Cyclops strenuus	..	+	+	+	+	+	..	..	..	+	+	+	+	40	28	34	..	+	..	.	?	+	..	..	..	..	..	..	+	..	..
,, ,, *(vicinus)*	..	+	+	+		+	+	+	..	+	+	+	+	40	9		+	+	..	+	+	+	..		+	..	+	..	..	..	+
,, [illegible]	..	..	+	+	+	+	+	+	+	+	+	..		52	17		+	+	+	+	+	+	..	..	..	+	+	+	..	+	+
,, [illegible]	..	..	..	..	+	+	+	+	+	+	..	.	..	28	9		+	+	+	..	+	+	..	..	..	..	+	..	+	..	..
,, [illegible]	.	..	..	..		+	..	..	..	..	..	..	..	1	1		..	..		..	..	..	..	..	..	..	..	..	..	+	..
,, [illegible]	..	+	+	+	+	+	+	+	..	+	+	+	+	56	24		+	+	..	+	+	+	..	+	..	..	+	..	+	..	..
[illegible]	..	+	+	+	+	+	..	..	..	..	..	+	+	10	7		..	..	..	..	..	..	..	+	..	..	..	..	+	..	..
,, [illegible]	..	+	+	+	+	+	+	..	..	+	+	+	+	30	19		..	..	..	+	+	+	..	+	+	..	..	..	+	..	..
,, [illegible]	.		..	+	+	.	..	..	..	+	+		+	13	10		..	..	..	..	..	..	+	..	..	..	..	..	+	..	..
[illegible]		+	+	+	+	+	+	+	+	+	+	+	+	178	40		+	+	+	+	+	+	..	+	.	+	+	..	+	..	+
[illegible]		+	+	+	+	+	+	+	+	+	+	+	..	41	7		?	..	..	?	..	+	+	..	+	..	+	..	..	..	+
[illegible]	..	..	+	+	+		..	..	+	+	+	..	..	8	6			..		..	..	..	.	..	..	..	..	+	+	..	..
[illegible]	..			+	+	+	+	+	+	+	+	+	+	70	19		+	+	+	+	+	+	..	+	..	+		+	+	+	+
,, [illegible]	..	+	+	+	+	+	+	+	+	+	+	+	+	122	25		+	+	+	+	+	+	..	+	+	+	+	+	+	+	+
[illegible]	..	..		+	+	..	..	..	+	..	+	+	+	3	3			..	.	..	.	..	..	..	..	..	..	..	..	..	..
[illegible]	..	+	+		+	+	+	+	+	+	+	+	+	226	51		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
[illegible]	..	+	+		+			..	..	..	..	.	..	1	1		..	.	.	..	+	+	..		..	..	..	..	.	..	..
[illegible]	..	+	+	+	+	+		..	+	+	+	+	..	8	4		..	..	..	..	..	..	..	+	..	..	..	..	..	+	..
[illegible]	..	..	..	+	+	..	..	..	..	+	+	..	..	9	6		..	..	+	+	+	+	..	..	..	+	..	+	+	..	..
[illegible]	..		..	+	+	+	+	..	+	+	+	+	..	12	11			..	+	..	+	+	..	+	..	+	+	..	..	+	..
[illegible]	..	+	+	+	+	+	+	..	+	+	+	+	+	27	12		.	+	+	+	..	+	+	..	+	..	+	+	..	..	..
[illegible]	..	+		+	+	+	+	+	+	+	+	+	+	174	41		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
[illegible]	..	..	..	..	..	+	+	..	+	+	+	+	..	5	4		..	+	+	..		+	..	..	..	..	..	..	..	..	..
[illegible]	..	+	+	+		+	+	+	..	+	..	..	+	15	10		..	..	..	+	..	+	..	..	..	+	..	..	+	..	..
[illegible]		..	..	..	..	..	..		..	..	..	..	+	1	1		.	..	..	..	..		..	..	..	..	.	..	..	..	..
[illegible]	..	..	+	..	..	..		..	..	+		..	+	3	2		.	..	..	..	..	..	..	..	..	..	..	..	+	..	..
[illegible]	.	+	+	+	+	+	+	+	+	+	+	+	+	38	22		..	..	+	+	+	+	..	+	+	..	+		+	+	..
[illegible]	..	..	..	..			+	..	..	..	+	..	..	2	1		..	..	..	..	+	+	..	..	..	..	..	..	..		..
[illegible]		..	+	..	+	+	..	..		+	+	..	..	4	1		..	..	..	..	..	..	..	..	+	..	..	..	..	..	.
[illegible]	..		..	..	..	..		..	..	+	+	..	+	3	2		..	..		..	..	..	..	..	..	..	..	..	+	..	..

complete local list of British Fresh-water Entomostraca yet published. It considerably exceeds Mr. T. Scott's list of 85 species of fresh-water Entomostraca from the district around Edinburgh (68), which has hitherto held the first place in this respect. In the paper on the Wanstead Park Entomostraca a comparison was made between the number of species recorded in each Order, and the total number then known to be British. During the period of five years that has elapsed, a very considerable number of additions have been made to the recorded British Entomostracan fauna, more especially to the Copepoda by Messrs. T. and A. Scott. It may prove interesting to repeat the figures previously given, and to make a similar comparison of the number herein recorded from Epping Forest with those now known to inhabit the fresh waters of the British Isles. This is done in the following statement:—

		Phyl.	Clad.	Bran.	Ost.	Cop.	Total.
1892	Total British ..	2	63	1	51	38[3]	155
	Wanstead Park ..	0	33	1	12	14	60
1897	Total British ..	2	75	1	58	54	190
	Epping Forest ..	(1?)	47	1	22	32	102
	Wanstead Park ..	0	36	1	13	21	71

Species recorded for first time as British.

The list now published contains three species, and one variety, new to the British fauna—namely, *Ceriodaphnia scitula* Herrick, *Diaptomus vulgaris* Schmeil (=*D. cœruleus* Fischer), *Cyclops bistriatus* Koch, and a variety of *Acroperus harpæ* Baird. A few remarks on each of these will be given in the detailed notes on the species.

In addition to the foregoing, a good many species appear in the Epping Forest list, which, although already placed upon record as British, were found for the first time during the examination of the district. Some of these are *Ceriodaphnia megalops*, *C. quadrangula*, *Chydorus latus*, *Candona pubescens*, *Cyclops leuckarti*, *C. oithonoides*, *C. dybowskii*, *C. languidus*, *C. bicolor*, &c.

Periodicity of certain species.

The facts obtained relating to the periodicity of a number of species, during the investigation into the Wanstead Park Entomostracan fauna, have been in the main very closely paralleled by the results from the whole Epping Forest district. To illustrate this I cannot do better than adopt the form of table prepared for the Wanstead Park species. In that table the earliest and latest months of capture of the commoner or more striking species exhibiting periods of activity and extinction, as shown by the records for the three years 1890-92, were connected by a series of crosses, one for each month, whether an actual record had been made for each of the intermediate months or not. Pursuing the same method, and separating the results obtained at Wanstead Park in 1890-92 from those of the rest of Epping Forest during the period 1890-97, we get the following statement (Table II.) :—

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[3] This includes five species of parasitic Copepoda which were not taken into account in the Wanstead Park paper.

EPPING FOREST ENTOMOSTRACA.

TABLE II. SHOWING THE SEASONAL DISTRIBUTION OF THE COMMONER SPECIES EXHIBITING PERIODICITY, WITH A COMPARISON BETWEEN THE RECORDS FROM WANSTEAD PARK AND THOSE FROM THE REST OF THE EPPING FOREST DISTRICT.

SPECIES.		Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Sida crystallina	W. P.	..	..	..	..	..	..	..	..	+	+	+	..
	E. F.	..	..	..	..	..	..	..	..	..	..	..	..
Diaphanosoma brandtianum	W. P.	..	..	..	..		..	+	+	+	..	..	..
	E. F.	..	..	..	..	+	+	+	+	..	..	..	..
[illegible]	W. P.	..	..	..	..	+	+	+	+	+	+	..	..
	E. F.	..	..	..	+	+	+	+	+	+	..	..	..
[illegible]	W. P.	..	..	..	..	..	+	+	+	+	+	+	+
	E. F.	..	..	..	..	..	+	+	+	+	+	+	..
[illegible]	W. P.	..	..	..	..	+	+	+	+	+	+	+	..
	E. F.	..	..	..	+	+	+	+	+	+	+	+	..
[illegible]	W. P.	..	..	+	+	+	+	+	+	+	+	+	..
	E. F.	..	..	..	+	+	+	+	+	+	+	+	..
[illegible]	W.	..	..	..	+	+	+	+	+	+	+	..	..
	[illegible]		..	..	..	+	+	+	+	+	+	..	..
[illegible]	W.	..	..	..	..	..	+	+	+	+	+	+	..
	[illegible]	..	..	..	..	..	+	+	+	+	+	..	..
[illegible]	[illegible]	..	..	..	..	..	+	+	+	+	+	+	..
	[illegible]		..	..	+	+	+	+	+	+	+	+	..
[illegible]	W.	..	..	..	+	+	+	+	+	+	+	+	+
					+	+	+	+	+	+	+	+	+

[illegible] Wanstead Park has not been taken into [illegible]

TABLE II.—*continued.*

SPECIES.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Eurycercus lamellatus	W.P.	+	..	..	+	+	+	+	+	+	+	+	+
	E.F.	..	..	..	..	+	+	+	+	+	+	..	..
Camptocercus rectirostris	W.P.	..	..	..	..	..	..	+	+	+	+	+	..
	E.F.	..	..	..	..	..	+	+	+	+	+	..	..
Alona costata	W.P.	..	..	..	..	..	..	+	+	+	+	+	..
	E.F.	..	..	..	+	+	+	+	+	+	+	+	..
Pleuroxus trigonellus	W.P.	..	..	..	+	+	+	+	+	+	+	+	+
	E.F.	+	+	+	+	+	+	+	+	+	+	+	+
Peracantha truncata	W.P.	..	..	+	+	+	+	+	+	+	+	+	+
	E.F.	..	..	+	+	+	+	+	+	+	+	+	+
Chydorus globosus	W.P.	..	..	+	+	+	+	+	+	+	+	+	+
	E.F.	..	..	..	..	+	+	+	+	+	+	+	+
Cypria ophthalmica	W.P.	+	+	+	+	+	+	+	..	..	..	+	+
	E.F.	+	+	+	+	+	+	+	..	+	+	+	+
Cypris fuscata	W.P.	+	+	+	+	+	..	..	..	+	+	+	+
	E.F.	+	+	+	+	+	..	..	..	+	+	+	+
Notodromas monacha	W.P.	..	..	..	..	..	+	+	+	+	+	..	..
	E.F.	..	..	..	..	..	..	..	..	..	..	..	..
Candona candida	W.P.	+	+	+	+	..	..	..	..	..	..	+	+
	E.F.	+	+	+	+	..	..	..	..	..	+	+	+
,, *fabæformis*	W.P.	+	+	+	+	..	..	..	..	+	+	+	+
	E.F.	+	+	+	+	+	..	..	..	..	+	+	+
Diaptomus castor	W.P.	+	+	+	+	+	+	..	..	..	..	+	+
	E.F.	+	+	+	+	..	..	..	..	+	+	+	+
Cyclops leuckarti	W.P.	..	+	+	+	+	+	+	+	+	+	..	..
	E.F.	..	..	+	+	+	+	+	+	+	+	..	..
,, *oithonoides*	W.P.	..	..	..	+	+	+	+	+	+	..	..	..
	E.F.	..	..	..	+	+	+	+	+	..	..	..	..
,, *strenuus*	W.P.	+	+	+	+	+	+	..	..	+	+	+	+
	E.F.	+	+	+	+	+	+	+	..	+	+	+	+
,, *bicuspidatus*	W.P.	+	+	+	+	+	+	..	..	+	+	+	+
	E.F.	+	+	+	+	+	+	+	..	+	+	+	+
,, *vernalis*[5]	W.P.	..	..	..	..	..	..	..	..	..	..	..	..
	E.F.	+	+	+	+	+	+	..	..	+	+	+	+

It will be seen that, in the majority of cases, the periods of activity, as shown by the records from Wanstead Park and the rest of Epping Forest respectively, agree very well indeed. In five instances, however—namely, *Pleuroxus trigonellus*, *Bosmina longirostris*, *Cypria ophthalmica*, *Cyclops strenuus*, and *C. bicuspidatus*, the supposed annual period of extinction probably does not exist, for the first-mentioned species has been found at all times of the year; and each of the others in eleven months out of the twelve. But it is only fair to remember that the method of taking the earliest and latest records obtained during a period of several years is a very severe test of periodicity, as it is one which probably more than compensates for the imperfections and accidents of collection.

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[5] The records of this species from Wanstead Park were unfortunately included with those of *Cyclops bicuspidatus.*

Besides the species given in the table it is very probable that several others are periodic in their appearance (e.g. *Eurytemora lacinulata*), but the small number of times they have been seen renders a definite statement on this subject impossible at present.

Seasonal distribution of species.

Owing to the want of system in collecting, it is quite out of the question to attempt to obtain the cycle of seasonal distribution of species for the whole district by taking the averages for each month during the whole period, as was done with the Cladocera of Wanstead Park. The best that can be made out of the data at command is to show the months in which each species has been found, and to deduce from this the approximate cycle of seasonal distribution. This has been carried out in the twelve columns following the names of the species in Table I. Granted that the collections are fairly numerous, that they are made without any special object except that of getting an exhaustive list of species, and further, that they are not spread over too long a period (so as to avoid the inclusion of a number of exceptional seasons), then this method should give approximate results of real value, although, of course, not for a moment to be put before those obtained by more systematic work. In the present case the results yielded by the foregoing method, from the data supplied by the whole Epping Forest area, correspond remarkably well with those obtained by the "average" method from Wanstead Park. This will be clearly seen from the following summary which gives the number of species of each of the three main groups of fresh-water Entomostraca taken in each month:—

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cladocera.	Wanstead Pk. '90-92	4	7	6	11	12	16	18	15	20	18	17	10
	Rest of Epping Forest '90-97	11	8	15	25	28	27	27	20	32	27	26	17
	Total Epping Forest '90-97	14	14	18	29	28	29	33	26	41	35	33	20
Ostracoda.	Wanstead Pk. '90-92	6	8	7	6	4	4	5	3	5	5	4	4
	Rest of Epping Forest '90-97	7	10	11	8	8	9	3	2	10	8	9	9
	Total Epping Forest '90-97	9	13	16	12	10	10	7	5	14	12	11	10
Copepoda.	Wanstead Pk. '90-92	9	9	9	11	8	10	7	7	8	7	8	9
	Rest of Epping Forest '90-97	12	15	17	21	20	18	12	12	22	22	19	17
	Total Epping Forest '90-97	14	16	18	22	22	19	13	13	23	22	19	18

As was pointed out in the Wanstead Park paper, the Cladocera reach their maximum development, as regards number of species, in September, and their minimum in January, whilst the otherwise fairly steady rise from the latter month to the former is interrupted by a marked reduction in August. The supposed retrogression in March has not been confirmed. As regards the Ostracoda the facts seem to show that there are two maxima—namely, one in early spring (March), which is the larger, and one in early autumn (September). Of the two minima, that in August is much lower than that in January. The Copepoda do not exhibit very much variation during the year from the point of view of the number of species, but the figures given suggest that there may be, as in the case of the Ostracoda, two maxima—namely, one in spring (April), and the other in early autumn (September). These maxima are practically equal in intensity. The two minima are also nearly equal, but that in the summer (July and August) is somewhat smaller than that in the winter (January).

Comparative abundance of the different species.

The question of the comparative abundance of various species—*i.e.* of the rare and common forms, is certainly one that deserves more attention than it has hitherto received. When dealing with the lower forms of animal life, and especially with the fresh-water forms, which are notorious for their wide distribution, it is not always possible to obtain good evidence of variations in the characters of the faunas of different districts from a mere enumeration of the species. But if the relative abundance of the various members of the local faunas could also be taken into account I feel convinced that some very striking differences would be brought to light.

The exact determination of the abundance of any species is necessarily out of the question, but rough and ready approximations of practical value may be obtained by the simple method of recording (1) the total number of times, and (2) the total number of stations at which each species has been obtained in the area under consideration. If the collections from each station were equal in number, then the first series of figures would directly represent the relative abundance of the different species, and the second series the relative distribution, whilst by a comparison of the two we should be able to make out several other important facts. Thus if in the case of any particular species the number of records (A) were high and the number of stations (B) also high, then the species must be an exceedingly common one, for it is evidently very constant in its occurrence and at the same time widely distributed. If, however, A were comparatively high and B low, then the species would be restricted in its distribution, although very constant in its own particular haunts. Again if A were comparatively low and B high, then the species must be fairly well distributed but very inconstant in its appearance. Finally if both A and B were low, then presumably the species must be rare in the district. In connection with the latter point, however, it should be borne in mind that arguments based on small figures are much more likely to be wrong than those based upon large ones.

But it is not always possible to collect regularly from each station, and then some of the conclusions to be drawn from an examination of the two series of figures mentioned are not quite the same as those given above. The total number of records for instance of any given species does not necessarily represent its abundance-value for the whole district, although it probably does do so nine times out of ten. But in the tenth case a very high figure representing the number of records, associated with a comparatively low figure for the number of stations, or *vice versâ*, may be explained by the fact of comparative over-collection in a few favoured stations and under-collection in others, rather than by the exceptional constancy or inconstancy in the appearance of the species as stated above. The only method under these circumstances by which to get a single series of numbers representing approximately the relative abundance of the species in the whole district would be to use the following formula $\frac{A}{C} \times B$, where A and B have the same values as before, and C equals the total number of collections made at the particular stations at which each species has been found.

It would not be worth while in the present instance to calculate a series of numbers in the manner suggested above, because of the many imperfections in the records, in addition to that of unequal collecting at the various stations. It will be much simpler, and probably not very far wrong in the case of the commoner species, to consider that the total number of records represents a fair approach to an accurate measure of relative abundance. Tabulating the species then on this basis, and dividing them arbitrarily into six divisions according to their degrees of commonness or the reverse, we get the following statement for the Epping Forest Entomostraca : –

EXCESSIVELY COMMON SPECIES.

Cyclops serrulatus	226 R.[6]	51 S.[6]	*Canthocamptus staphylinus*	174 R.	41 S.
Chydorus sphæricus	197 ,,	48 ,,	*Diaptomus gracilis*	138 ,,	19 ,,
Simocephalus vetulus and exspinosus	186 ,,	38 ,,	*Cyclocypris serena*	129 ,,	23 ,,
Cyclops viridis (*gigas*)[7]	178 ,,	40 ,,	*Cyclops albidus*	122 ,,	25 ,,

COMMON SPECIES.

Peracantha truncata	88 R.	17 S.	*Cypria ophthalmica*	68 R.	26 S.
Daphnia longispina and lacustris	85 ,,	9 ,,	*Alona quadrangularis*	67 ,,	16 ,,
Cyclops strenuus	80 ,,	34 ,,	*Ceriodaphnia quadrangula*	63 ,,	11 ,,
Pionocypris vidua	80 ,,	17 ,,	*Daphnia pulex*	60 ,,	25 ,,
Cyclops fuscus	79 ,,	19 ,,	*Eurycercus lamellatus*	56 ,,	10 ,,
Acroperus harpæ	79 ,,	14 ,,	*Cyclops bicuspidatus*	56 ,,	24 ,,
Bosmina longirostris	71 ,,	9 ,,	,, *leuckarti*	52 ,,	17 ,,

FAIRLY COMMON SPECIES

Candona candida	44 R.	14 S.	*Canthocamptus pygmæus*	38 R.	22 S.
Pleuroxus trigonellus	44 ,,	11 ,,	*Cypris fuscata*	38 ,,	19 ,,
Scapholeberis mucronata	43 ,,	7 ,,	*Cyclops vernalis*	36 ,,	19 ,,
Cyclops viridis brev.	41 ,,	7 ,,			

RATHER RARE SPECIES.

Chydorus globosus	30 R.	8 S.	*Bosmina cornuta*	17 R.	7 S.
Graptoleberis testudinaria	29 ,,	11 ,,	*Leydigia quadrangularis*	17 ,,	6 ,,
Ceriodaphnia megalops	28 ,,	10 ,,	*Camptocercus rectirostris*	16 ,,	2 ,,
Cyclops oithonoides	28 ,,	9 ,,	*Canthocamptus trispinosus*	15 ,,	10 ,,
" *fimbriatus*	27 ,,	12 ,,	*Pleuroxus uncinatus*	15 ,,	5 ,,
Herpetocypris reptans	27 ,,	6 ,,	*Cypris virens*	14 ,,	10 ,,
Ceriodaphnia rotunda	26 ,,	14 ,,	*Alona costata*	14 ,,	7 ,,
,, *reticulata*	24 ,,	10 ,,	,, *rectangula*	14 ,,	6 ,,
Macrothrix laticornis	24 ,,	10 ,,	*Daphnia galeata ?*	14 ,,	2 ,,
Daphnia obtusa	23 ,,	16 ,,	,, *cucullata ?*	14 ,,	2 ,,
Alonella nana	23 ,,	12 ,,	*Cyclops bisetosus*	13 ,,	10 ,,
Ilyocryptus sordidus	22 ,,	10 ,,	*Ilyocypris gibba*	13 ,,	6 ,,
Diaptomus castor	21 ,,	9 ,,	*Notodromas monacha*	13 ,,	4 ,,
Candona pubescens	20 ,,	4 ,,	*Cyclops phaleratus*	12 ,,	11 ,,
,, *fabæformis*	18 ,,	7 ,,	*Daphnia hyalina*	12 ,,	6 ,,
Alona guttata	17 ,,	10 ,,			

RARE SPECIES.

Cyclops languidus	10 R.	7 S.	*Cyclocypris lævis*	7 R.	5 S.
Diaphanosoma brandtianum	10 ,,	4 ,,	*Argulus foliaceus*	7 ,,	4 ,,
Alona tenuicaudis	9 ,,	6 ,,	*Alonella excisa*	7 ,,	3 ,,
Cyclops affinis	9 ,,	6 ,,	*Sida crystallina*	7 ,,	2 ,,
Limnicythere inopinata	9 ,,	3 ,,	*Eurytemora lacinulata*	7 ,,	1 ,,
Daphnia magna	8 ,,	6 ,,	*Herpetocypris strigata*	6 ,,	5 ,,
Cyclops bicolor	8 ,,	6 ,,	*Alona affinis*	6 ,,	4 ,,
,, *prasinus*	8 ,,	4 ,,	*Alonella rostrata*	6 ,,	3 ,,
			Canthocamptus minutus	5 ,,	4

[6] R = records, S. = stations.

[7] Only the "gigas" form has been considered here; if the "brevicornis" form were included, *C. viridis* would take the second place.

VERY RARE SPECIES.

Chydorus latus	4 R.	3 S.	*Cypridopsis villosa*	2 R.	2 S.
Candona lactea	4 ,,	3 ,,	*Ceriodaphnia scitula*	2 ,,	1 ,,
Nitocra hibernica	4 ,,	1 ,,	*Diaptomus vulgaris*	2 ,,	1 ,,
Cypris reticulata ?	3 ,,	3 ,,	*Canthocamptus zschokkei*	2 ,,	1 ,,
Cyclops bistriatus	3 ,,	3 ,,	*Moina rectirostris*	1 ,,	1 ,,
Canthocamptus crassus	3 ,,	2 ,,	*Macrothrix hirsuticornis*	1 ,,	1 ,,
Moraria anderson-smithi	3 ,,	2 ,,	*Alona rustica*	1 ,,	1 ,,
Monospilus tenuirostris	3 ,,	1 ,,	*Chydorus cœlatus*	1 ,,	1 ,,
Herpetocypris tumefacta	3 ,,	1 ,,	*Cypria exsculpta*	1 ,,	1 ,,
Candona compressa	3 ,,	1 ,,	*Cyclops dybowskii*	1 ,,	1 ,,
Cypris incongruens	2 ,,	2 ,,	,, *macrurus ?*	1 ,,	1 ,,
,, *obliqua*	2 ,,	2 ,,	*Canthocamptus northumbricus*	1 ,,	1 ,,

Faunas of some well-known Forest ponds, &c.

The full lists of species from the principal ponds in the Epping Forest district are given in Table I., but it will probably be useful also to point out the peculiarities exhibited by these and some other typical collecting stations.

Wanstead Park Ponds. Three of the four principal ponds in Wanstead Park—namely, the "Heronry" pond, the "Lake," and the "Shoulder of Mutton" pond, are very similar in general character. They are very shallow, with abundant aquatic vegetation, which not only occurs near their margins, but often extends well out from the shore. The "Perch" pond is of rather a different type, being slightly deeper than the others, at least at its eastern end, and its aquatic vegetation is closely confined to the margins. Each of the four ponds shows a very good list of Entomostraca, most of the species being common to all, but the "Perch" pond is distinguished from the others by the presence of the hyaline Daphnias (*D. hyalina*, *D. galeata ?*, and *D. cucullata ?*), *Camptocercus rectirostris*, and *Pleuroxus uncinatus*, and by the absence of *Daphnia pulex*, *Cyclops strenuus* and *C. bicuspidatus*. The distinguishing species of the "Lake" are *Cypria exsculpta* and *Diaptomus vulgaris*, of the "Shoulder of Mutton" pond, *Sida crystallina*, *Leydigia quadrangularis*, and *Ilyocypris gibba*. One of the smaller ponds of the Park (now filled up) yielded *Diaptomus castor*, and the swamp between the "Perch" pond and the "Lake" is the only spot where *Canthocamptus zschokkei* has been taken in the district.

On the whole, Wanstead Park is certainly the richest collecting ground for Entomostraca within the Epping Forest area.

Connaught Water, Chingford. This well-known pond is characterised by an almost complete freedom from aquatic vegetation, and by the possession of a soft clayey bottom which renders the water turbid upon very little disturbance. The Entomostracan fauna, corresponding with these peculiarities, consists mainly of two sharply divided groups—namely, Plankton-forms and Mud-lovers. There are, of course, as in most other ponds, a few of the universally distributed forms also present, but they do not affect the general character of the fauna. To the group of plankton species belong *Daphnia hyalina*, *Bosmina longirostris*, *B. cornuta*, and *Cyclops viridis* (*brevicornis*). Strangely enough *Diaptomus gracilis*, which almost invariably accompanies such forms as the foregoing, has never been taken in this pond. The reason for this is a mystery to me. I can only suggest that it may be connected with the frequent cloudiness of the water. The mud-loving and bottom forms are well represented by *Macrothrix* (two species), *Ilyocryptus*, *Leydigia*, *Alona quadrangularis*, *A. affinis*, *Pleuroxus uncinatus*, *Cypria ophthalmica*, *Ilyocypris*, *Limnicythere*, &c. The best find from this station, perhaps also the best from the whole district, has been *Macrothrix hirsuticornis*. Unfortunately, however, it was only seen on one occasion, although present then in fair abundance. It seems to have failed altogether in establishing itself. I consider it to be very probable that the resting eggs of this species were introduced [8] by some of the wild ducks or similar birds occasionally frequenting the pond, and that, after hatching and undergoing a brief period of parthenogenetic development, the species found the conditions incompatible with its further existence.

Cuckoo Pits, Chingford. The three or four little ponds and pools occupying the hollows known as Cuckoo Pits, are situated in a small clearing in one of the densest parts of the Forest. They are very shallow, almost completely choked with weeds, and, with one exception, dry up in the hottest part of the summer. The Entomostracan fauna of these ponds is characterised by the presence of the three littoral Ceriodaphnias (*C. megalops*, *C. rotunda* and *C. reticulata*) and absence of the semi-pelagic *C. quadrangula*, and by the presence of *Daphnia obtusa*, *Alonella excisa*, and three species of *Cyclops* of the "bicuspidatus" group—namely, *C. bicuspidatus*,

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[8] Perhaps from the north. The only previous British records have been Sunderland and Shetland.

C. languidus, and *C. vernalis*. The rarest species found here has been, perhaps, *Cyclops prasinus*.

Eagle Pond, Snaresbrook. At first sight this pond appears similar in type to Connaught Water, as it is quite free from evident vegetation. It is however, probably much deeper than Connaught Water, and, more important still, it has a clean gravelly bottom instead of clay, at least for some considerable distance from the shore. In consequence of this its waters are never turbid. The two groups of species—namely, plankton and bottom, forms furnish in this case also the great majority of the Entomostraca, but the number of species is much greater than in Connaught Water, and there are, moreover, a greater number of the common forms which find a home almost anywhere. Eagle Pond is, in fact, from the point of view of the student of Entomostraca, a kind of very superior Connaught Water. The plankton species are the same as in the latter, but with the addition of *Diaphanosoma brandtianum*, *Ceriodaphnia quadrangula*, *Daphnia galeata ?*, *D. cucullata ?*, *Diaptomus gracilis*, and *Cyclops strenuus* (*vicinus*). The bottom dwellers are also practically the same with some important additions, such as *Camptocercus rectirostris*, *Alonella rostrata*, *Monospilus tenuirostris*, &c. Eagle Pond has yielded two very good things which have not been found elsewhere within the district—namely, the species last mentioned and *Nitocra hibernica*.

Goldings Hill Ponds, Loughton. These ponds belong to a rather common type with luxuriant plant growth and do not present any very striking features in the way of Entomostraca. It may be noted, nevertheless, that a variety of *Acroperus harpæ* has been found in these ponds which has not been taken at any other station.

Higham Park Lake. This is a very good all-round collecting ground for Entomostraca. It is somewhat like the "Perch" Pond, Wanstead Park, in general character, but harbours more vegetation, especially large beds of water-lilies, and is apparently not quite so rich in species. However, it has given two rarities to the Forest list—namely, one of our rarest British fresh-water Copepods, *Eurytemora lacinulata*, which is found in it pretty abundantly at times, and *Ceriodaphnia scitula*, which has hitherto only been found in the United States.

Hollow Pond, Leyton Flats. There is nothing very remarkable about the records from this pond, the rarest species found in it having been *Ilyocryptus sordidus*, *Pleuroxus uncinatus*, *Cyclops bicolor*, and *C. affinis.* I have been tempted to specially mention this pond, however, because of the extensive alterations to which it has been subjected this year, by which its normal area will be increased some three or four fold. It will be very instructive to watch what effect these changes will have upon the Entomostracan fauna.

Leyton Flats. The numerous pools and two or three little ponds (exclusive of the "Hollow" pond) on the open space bounded by Leytonstone, Walthamstow, and Snaresbrook, and known as Leyton Flats, have together yielded a very considerable number of Entomostraca. In general the species are similar to those obtained at Cuckoo Pits, but there are a good many additional forms. Some of the most important of these are *Chydorus latus*, *Diaptomus castor*, *Cyclops bisetosus*, *C. bicolor*, *Canthocamptus crassus*, *Moraria anderson-smithi.*

Wake Valley Pond. This fine pond, although not showing such an extensive array of species as some of the others, is nevertheless a very fair collecting station, and has yielded one species, *Cyclops dybowskii*, which has not been noticed anywhere else in the district. Another characteristic feature is the almost constant presence of the rare *Cyclops prasinus.*

Warren Pond, Chingford. The extensive shallow muddy margins of this pond render it a somewhat troublesome one to collect from, and the total number of species seen here has not been so great as might have been anticipated. The occurrence, however, of *Moina rectirostris* in considerable numbers in August, 1896, more than compensates for any shortcomings in other respects.

Various small Forest Pools. Scattered about all over the actually existing Forest there are frequently to be found little pools among the trees, which usually totally disappear in the summer. The Entomostraca to be found in any one of these scarcely ever exceed two or three species, although taken collectively some dozen species have been seen from such localities. The really characteristic feature of such pools seems to be the presence of one or more forms of

Cyclops of the "bicuspidatus" group—*i.e.*, either *C. bicuspidatus*, *C. vernalis*, *C. languidus*, or *C. bisetosus*. If, as often happens, the pool contains moss, then *Canthocamptus pygmæus* is almost sure to be present.

Various Duck Ponds. In various places on the outskirts of the actual Forest are to be found, mostly by a road-side, a number of little duck-ponds which deserve mention, as they have contributed three species to our list not obtained elsewhere. They are, moreover, worthy of notice from the peculiarly constant facies of their Entomostracan fauna. The chief of these ponds examined have been two near Chingford Hatch, one at High Beach village, three at Sewardstone, one on Theydon Bois Green, and one near the "Volunteer." The two peculiarities about this type of pond which strike an observer at once are the entire absence of weeds, and the turbidity of the water. The collector of Entomostraca also finds correlated with these characters the almost invariable presence of three particular species—namely, *Daphnia obtusa*, *Cyclops strenuus*, and *Cypria ophthalmica*. Three other species occur less constantly, but are only to be found in these duck-ponds, and may therefore also be considered characteristic. These are *Daphnia magna*, *Cypridopsis villosa*, and *Cypris incongruens*. In addition to the above there may be found occasionally one or two other species, usually very common forms, such as *Chydorus sphæricus* and *Cyclops serrulatus*.

Males and "Ephippial" Females of Cladocera.

Since the publication of the paper on the Wanstead Park Entomostraca, the males and "ephippial" females of a considerable number of additional species of Cladocera have been seen in the Forest district, and some further information obtained as to the times of appearance of these forms. The full details, including the records from Wanstead Park, are given in Table III., in which each sign (+ or ∗) represents a distinct record. In the main, the cycle of seasonal distribution of these sexually mature individuals, from the whole district, closely agrees with that already made out in connection with the Wanstead Park forms. This will be apparent from the following statement of the number of species found to be producing males and "ephippial" females in each month:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Wanstead Park	0	0	0	1	3	3	1	1	7	10	7	1
Total Epping Forest	0	1	0	4	7	4	1	4	16	17	15	5

EPPING FOREST ENTOMOSTRACA.

TABLE III. SHOWING THE SEASONAL DISTRIBUTION OF THE MALES AND "EPHIPPIAL" FEMALES OF THE CLADOCERA.

(*Note.*—Each sign represents a distinct record ; the sign + represents Male, and the sign * represents the Ephippial Female.)

SPECIES.	1890–1897.											
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Leydigia quadrangularis	. .	. .	. .	. .	. .	. .	. .	. .	+	. .	. .	. .
Graptoleberis testudinaria	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	+ * *	. .
Alona tenuicaudis	. .	. .	. .	. .	. .	. .	. .	. .	+ *	. .	. .	. .
,, *quadrangularis*	. .	. .	. .	. .	*	. .	. .	. .	. .	. .	. .	. .
,, *costata*	. .	. .	. .	. .	. .	. .	. .	. .	. .	*	+ + * *	. .
Alonella excisa	. .	. .	. .	+	.	. .	. .	. .	. .	. .	. .	*
,, *rostrata*	. .	. .	. .	. .	. .	. .	. .	. .	+	. .	*	. .
Pleuroxus trigonellus	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	*	*
,, *uncinatus*	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	*	. .
Peracantha truncata	. .	. .	. .	. .	. .	. .	. .	. .	. .	+ + * * *	+ + + + * * * * *	* *
Chydorus sphæricus	. .	*	. .	+ + + * * * * *	+ * * *	. .	. .	. .	. .	. .	+ * * *	*
	0	1	0	4	7	4	1	4	16	17	15	5

A glance at the above will be sufficient to show that, taking the Cladocera as a whole, there are, in each year, two seasons of exceptional activity in the production of the sexually mature individuals. The sexual season *par excellence* is evidently the autumn, October being the month of greatest activity, but in addition to this there is also a period of moderate activity in the spring, reaching its maximum in May. The number of species affected in the latter case, however, is very limited.

Looking to the individual species we find that, although for the majority the sexual period is confined to the autumn, some of the forms are affected during both periods, e.g. *Ceriodaphnia megalops* (?), *C. quadrangula* (?), *Simocephalus vetulus*, *Alonella excisa* (?), and *Chydorus sphæricus*. Others, again, appear to have only one annual sexual period in the spring, e.g. *Daphnia magna*, *D. obtusa*, and *Alona quadrangularis* (?), whilst in the case of *Daphnia longispina* (including *D. lacustris*), there seems to be continuous sexual reproduction in progress from May to October, although it is much more pronounced in the latter month than at any other time.

So far as I can make out from the present records, it seems certain that the colonies of the same species inhabiting different pieces of water, behave very differently in this matter of sexual reproduction. Thus in the case of *Simocephalus vetulus*, the entries for which show two clearly defined periods, one in May and the other in October, it is only in ponds of small size that males and ephippial females have been found at all. This is most decided in the case of the spring period, all the records having been from quite tiny ponds or ditches. The size of the ponds was on the whole somewhat larger for the autumn records, but even in these cases the largest were the "Hollow" and the "Shoulder of Mutton" ponds. On the other hand, this species runs practically without a break through the three years' records from the "Perch" pond and yet never once yielded a male or an ephippial female. The same negative evidence is offered also by the "Lake" Wanstead Park, the "Heronry" pond and the Higham Park lake, but the records from these are not so continuous, and therefore not so convincing. The facts again in the case of *Chydorus sphæricus*, which also shows two sexual periods, one culminating in April and the other in November, are very much the same as in that of the foregoing species. The records of males and ephippial females during the earlier period are from pools and very small ponds with only one exception—namely, that a single ephippial female out of numerous individuals was taken in Connaught Water in April, 1894. The records for the later period differ from those for *Simocephalus vetulus* in that they are from rather larger pieces of water e.g. the Eagle Pond and the Higham Park lake. From the "Perch" pond again no males or ephippial females have ever been seen. The foregoing facts seem to me to show that the influence of environment upon the production of males and ephippial females, at least in certain cases, may be more direct than is admitted by Weismann in his excellent work on this subject (107).

There now only remains one other point in this connection to which reference need be made. If we assume, as appears quite allowable, that the number of records in any month gives a rough measure of the intensity of the production of the sexually perfect individuals, then the records from Epping Forest show that, of the species affected in the spring, some attain their maximum in April, e.g. *Chydorus sphæricus*, whilst others reach it in May, e.g. *Simocephalus vetulus*, *Daphnia magna*, and *D. obtusa*, and of the species affected in the autumn, some have their maximum in September, e.g. *Diaphanosoma brandtianum* (?) and *Ceriodaphnia megalops*, others in October, e.g. *Ceriodaphnia reticulata*, *C. quadrangula*, *Simocephalus vetulus*, *Daphnia longispina*, and *D. cucullata ?*, and yet others in November, e.g. *Sida crystallina* (?), *Alona costata*, *Peracantha truncata*, and *Chydorus sphæricus.*

[*To be continued.*]

THE PROTECTION OF WILD BIRDS IN ESSEX.

THE establishment of the "Essex Bird Society" was recorded by Mr. C. B. Russell in his article on the Shore Birds in the ESSEX NATURALIST for 1896 (vol. IX., pp. 318-222), and later the first Report of the Society was epitomised in the same volume (vol. IX., pp. 255-256). The Report for 1897 has now been issued, and the statements of the officers of the Society given therein are again distinctly encouraging. On the coast in some places, owing to high tides, the shore-birds had in 1897 a poor nesting season, but within the sea-walls the breeding birds experienced a good time. Precise localities are very wisely withheld by Mr. Russell, but the reporters agree in stating that since the passing of the Order under the "Wild Bird Amendment Act, 1880," by the Home Secretary on February 6th, 1896 (*vide* ESSEX NATURALIST, vol. ix., p. 44, and pp. 218-19), the breeding-places and nests have not been interfered with. One reporter writes:—

> "The society has done one good thing, it has stopped all our London sportsmen who used to come down almost every Sunday during June and July, of late years. This season, I have not seen one down during the close season. Catching the man (convicted of shooting a gull) at the beginning of the season, I think made the others pretty cautious about taking the eggs. Still, I find that they know just what time to come as soon as the close-season has ended. . . . . There were more birds about this season than I have seen for many years, and some of the Terns stayed very late this season."

Other remarks of the individual reporters as to the increase of birds may be quoted, *e.g.* :—

> "We had rather more of the Black-headed Gulls breeding here this year than last, also more ducks: I don't think the rooks destroyed quite so many of the latters' eggs. We had less Terns and 'Dottrels' [Ringed Plover, *Ægialitis hiaticula*], which I cannot account for, as we had such a lot last year"—"Wild-fowl were very favourable last year, and shore-birds the same."—"There seem to be a great number of wild-fowls and shore-birds."—"I think there has been an increase of Ducks and Peewits, but of all other birds a decrease."—"I think there is an increase of Ducks and Peewits."—"The gunners report that there are more wild birds about this winter than have been seen for several years."—"There were a great many Ducks bred last year."

At the January meeting of the Essex County Council it was resolved to apply to the Secretary of State for an extension of the Order protecting eggs in the coast area for five years. At the same meeting general approval was shown at the extension of the close-time to August 15th (March 15th—August 15th), as only three members supported the proposal that the close-time "should be restored to the 1st August, so far as wild fowl are concerned." Five rewards have been given for successful prosecutions in approved cases: (1) for shooting sea gull on foreshore in close-time (Walton), (2) for catching wild birds in close-time (Ongar), and (2) for violating "Epping Sanctuary" by taking birds in November. We understand that since the issue of the report, other convictions have been obtained. Altogether, Mr. Russell and his co-adjutors are to be congratulated on a good year's work, and the society should be supported by lovers of birds in the county. Mr. C. B. Russell's address is "Stubbers," near Romford.

No public report has yet been issued of the last year's work of the "Epping Forest Bird Protection League," but Mr. Buxton has kindly put into our hands some returns from the keepers and others which show that the protection continues to bear fruit. The objects of the League and the results of its operations up to February, 1897, were summarised in these pages (see E. N., vol. IX., pp. 49-50, and vol. X., pp. 56-57). The order constituting all the forest parishes a "Protected Area" under the Act of 1896 (see E.N., vol. X., p. 135) appears to be working well in stopping the London bird-catchers, but with regard to some of the districts outside the actual forest Mr. Buxton complains that the police are rather remiss in using their powers. Wanstead Park, owing to its extensive ponds and sheltered islands, is of increasing importance as a refuge for aquatic birds from the valleys of the Thames, Lea, and Roding. Wild ducks have greatly increased and the keeper is very keen about their preservation. The Heronry, which is an object of great interest to visitors, is noticed in Mr. Buxton's communication in the "Notes" in the present part. The following are some specific details from the observations of the keepers, and some gentlemen who are members of the League :—

Owls. All speak of having seen these, sometimes in increased numbers. The Brown Owl is noted as being more plentiful in Monk Woods. Mr. Buxton, a short time since, saw three Brown Owls together in the Forest, surrounded by a mob of jays, a sight which he had not noticed for some years.

Hawks. The Kestrel is apparently increasing, but there is some ambiguity in the reports. Most of the keepers distinguish between "Kestrels" and "Hovering Hawks" and it is a little doubtful what some of them mean by these terms. *Sparrow Hawk.* This bird is reported as being occasionally seen. One pair nested near Ambresbury Banks, and there were two nests at "Warlies," Waltham Abbey. In some parts it is feared that game-keepers still carry on an ignorant warfare against the Kestrels. *Magpies* have become exceedingly scarce, only three keepers having noted them ; one pair nested at "Warlies," and two were seen in Organ Lane, Chingford. *Kingfisher.* Occasionally seen ; a pair at Wake Valley Pond ; at "Warlies" it probably nested, as young birds were seen. Mr. T. F. V. Buxton reports that the "*Spotted Woodpecker*" nested at "Warlies."

We can hardly expect the hawks and larger birds to return and multiply very rapidly. Very many smaller birds are certainly more common. *Bullfinches* and *Hawfinches* are plentiful, and it is reported that a Mr. Cooper saw five *Goldfinches* on thistles in Hawk Wood. Every lover of birds would desire to see this beautiful species again plentiful in the forest districts.

It is worth while again calling attention to section 4 of the Wild Bird Act, 1896, providing that when any person is convicted of an offence against this Act, or the Principal Act, the Court may, in addition to any penalty, order any trap, net, snare or decoy-bird, used by such persons for taking any wild bird, to be forfeited. Hitherto, there had been no statutory justification for seizing the implements of offenders, when caught *flagrante delicto*.

THE HIGH TIDE OF NOVEMBER 29th, 1897.

"The old sea wall (he cried) is downe,
The rising tide comes on apace,
And boats adrift in yonder towne,
Go sailing up the market place!"

From Jean Ingelow's ballad "*The High Tide on the coast of Lincolnshire, 1571.*"

NOVEMBER and December last were rendered memorable in weather annals by gales and high tides which did much damage on the East and South Coasts. Although perhaps not exceptionally severe, by occurring co-incidently with a spring flood-tide, the Gale of Sunday, November 28th, produced most remarkable and disastrous effects in Essex.

Between noon and 4 p.m. on the Sunday, Mr. G. J. Symons, F.R.S., recorded a fall of the barometer in London of 0.30 in., but this rate of fall he remarks (in his *Monthly Meteorological Magazine*) was "by no means unprecedented and we have known the wind much stronger . . . . In the centre, E., and N. of England, the gale was much heavier, many chimneys and a few partly-built premises, trees, and telegraph posts were blown down; but tne damage was not comparable with that of the storms of March 24th, 1895, and March 3rd, 1897. Over the North Sea and south-westwards, as far as Boulogne, the wind force was, no doubt, great, but the chief source of mischief was due to the intensity of the storm occurring at nearly the time of high-water spring tide. Hence the eastern coasts, on both sides of the mouth of the Thames, suffered severely, buildings being wrecked or flooded at Southwold, Ipswich, Harwich, Ramsgate, Margate, Herne Bay, Whitstable, Sheerness, Southend, Purfleet, Woolwich, and other places."

In Essex great damage was done by the gale at Colchester, Halstead, Coggeshall, Chelmsford, Ingatestone, Dunmow, Ongar, and many other places, but it was by the floods and high tides which accompanied the gale on the coast and the borderlands of the estuaries of the Thames, the Blackwater, and the Colne, that the great destruction was wrought. The sea-walls were broken down in many places, and it is estimated that around the Essex coast about 50,000 acres of low-lying land within the walls was flooded by sea water. We give a few details of local phenomena and damage caused by the floods as examples. The facts are mainly taken from the reports in the local papers which devoted many columns to a record of the disaster:—

Harwich.—The gale caused great damage during Sunday evening, and even increased in violence next day. Several vessels were wrecked. By one o'clock on Monday the spray was breaking over the sea-wall, and in a short time fishermen's boats that had dragged their anchors were tossed over the wall on to the mud on the Harwich side. The tide continued to rise, and by two o'clock hundreds of people were on Bathside to witness a sight never before seen at Harwich. The whole extent of the sea-wall from the Continental Pier at Harwich to Dovercourt Station was one large cataract. Vessels were being driven up to the banks. A barge was lifted by a wave clean over the wall and floated on to the water inside. By three o'clock boats were being rowed a considerable distance up the main streets of Harwich. By half-past three very nearly the whole of the houses of Bathside were flooded, in some cases the water reached to the ceilings of the lower rooms, and got into the landings of the bed-rooms. On Tuesday morning people were imprisoned in their houses, and their pantries having been washed out, the baker's boys could be seen throwing hot rolls into the first-floor windows!

Walton-on-the-Naze and Neighbourhood.—At five o'clock on Sunday evening there was a very sudden and severe outburst of storm, which, however, quickly abated. Soon after 12 mid-day on Monday the tide was of the proportion of a spring-tide, but it had yet a long time to flow, and there was a strong wind which tossed the backwaters into a very rough condition, forcing the waves against the walls, and in a very short time making breaches, through which the waters rushed, covering the pastures. The basements of houses were soon flooded and traffic on the main road stopped. At the wall around Walton Hall Marsh the sea did great damage, breaking through in quite thirty different places, some of the breaches being several yards in length. Near Salt Creek, the top of the wall was taken off for quite 100 yards. At Horsey Island, of 1,000 acres, scarcely a tenth of the land escaped being submerged or washed by the rolling of the tide. At Pewit Island the tide had complete mastery, and many other lands were submerged. Between Frinton and Little Holland the sea-wall withstood the enormous pressure until very nearly the highest water, when a wide gap was caused, through which the sea rushed in an indescribable manner, flooding hundreds of acres of pasturage and low-lying fields, vast numbers of rats and ground game were drowned. At Clacton the sea rose to within a foot of the pier, and washed over the lower promenade; the sea-wall sustained a good deal of damage, and the higher part of the beach was raised three feet by the sand left behind when the tide ebbed.

Colne Estuary.—At St. Osyth the tide did considerable damage, breaking through the walls in two or three places, and completely flooding the marshes to the great danger of the cattle, which were with difficulty rescued. At West Mersea, Mr. T. Gilbert, J.P. stated that on the Monday "the tide commenced to flow with great rapidity, but started to ebb at about a quarter past two. Everyone, of course, thought that we had seen the worst, and were all right. After receding for about twenty-five minutes, however, the tide began to flow again more rapidly than before, and it reached a height never remembered to have been equalled by any person living in the neighbourhood. The marshes were completely covered, the sea carrying all before it as it poured in. They had an exciting time at what we call the 'City of Mersea,' the floors of houses being covered with three or four feet of water. People had to stand on chairs or anything else available, and even bedridden people had to be moved. A number of hares were drowned on Feldey Marshes, but I have not heard of the loss of any cattle." The Strood-way was impassable for hours.

At East Mersea the wall was broken through in several places; the bathing-huts on the "Hard" were carried out to sea and Mr. Bayard Brown's yacht, the "Valfreyia" dragged her anchor, and drifted higher up the river. Mr. Brown's steam launch was also carried away and she drifted out to the mouth of the estuary and there sank. "Baker's Boat," so well-known as a land-mark to frequenters of the estuary, shifted her moorings and narrowly escaped being carried out to sea.

In few places were the effects of the gale and high-tide more severely felt than in the portion of the Tendring Hundred immediately adjacent to the Colne, which river overflowed its banks to an extent never before known. Midway between the stations at Colchester, Hythe, and Wyvenhoe on the Tendring Hundred Branch, the river rose over the intervening meadows and crossed the railway, washing away a considerable portion of the embankment. Near Wyvenhoe the view presented to the traveller by rail was one of almost endless desolation, with here and there a tree-top or the roof of an outbuilding showing above the waste of waters, which in places was some nine or ten feet deep. The numerous yachts that were laid up at Wyvenhoe were riding atop of the river-wall, but fortunately none of them started their moorings. Just beyond Wyvenhoe Station the rise of the water was so great that the line to Brightlingsea was submerged to the depth of several feet, and miles of land on either side of the river were also under water, the general impression from the Clacton line being that of a great lake stretching almost as far as the eye could reach with, on the horizon, a dark cluster of woods marking the boundary of the great overflow. On Monday afternoon (Nov. 29th) the 2.3c train from Wyvenhoe to Brightlingsea was brought to a standstill, the goods break becoming derailed owing to the collapse of the line by the washing away of the ballast underneath the sleepers. Eventually the passengers were taken from the carriages in boats. Brightlingsea was flooded by the Hard, and in fact became an island, completely surrounded by water. The water inundated a number of the stores and shops on the water-side to the depth of two or three feet. Some low-lying houses on the banks of Brightlingsea Creek were swamped, and a number of the yacht store-houses at the bottom of New-street were lifted bodily from their foundations, whilst the hut belonging to the Sailing Club on St. Osyth Stone was carried some distance up the Creek.

At Tollesbury, Salcot, and Virley, a vast quantity of land was flooded, the breaches in the sea-walls being exceedingly numerous.

Maldon District.—Owing to the strong winds the tide came up shortly after three o'clock on the Monday, its due time being 4.15, and the swell was so heavy that 90 feet of the sea-wall at Messrs. Sadd's timber wharf was washed out. The breach was cut into the depth of about 16 feet, and the width of the wall at its deepest part would be about 30 feet. Large boulders, which formed part of its composition, some of them weighing upwards of two tons, were dashed and rolled about like pebbles. It is stated that the water rose to about six feet above the ordinary high-water mark. All the low-lying parts of Heybridge and Maldon and the Heybridge Basin were flooded. Similar relations might be made of all the land on the south side of the Blackwater, at Bradwell, St. Lawrence, and Steeple.

Dengie and Rochford Hundreds.—The heavy gales of Sunday (Nov. 28th) culminated on the Monday in the highest tide which has ever been known at Burnham-on-Crouch. In the morning the tide did not ebb until much more than half its proper time, and by eleven o'clock, at which time it should have turned to come up, it had flowed some feet. 3.39 was the time at which the tide should have been full in the afternoon, but at two o'clock it was level with the top of the Quay. By half-past two it was pouring down the opening against the Clay Shipping Company's Wharf into the High Street like a sluice. Soon afterwards it reached the High Street by other means, and by three o'clock the broad thoroughfare was flooded to a depth of from eighteen inches downwards. Soon after three o'clock, by a remarkable freak, the tide commenced to ebb, and fell away some six inches. But again it flowed, and the aspect of affairs was more serious than ever. Eventually the tide again ebbed at its usual time, and continued to do so for the rest of the evening. While the flood was at its height boats were brought into the street, and remarkable scenes were witnessed. The children of the National Schools were kept prisoners, but eventually they were carried across the flood in boats. These and the occasional upsetting of a boat and the ducking of people were among the most amusing scenes, but there is a far more serious aspect in the amount of damage done. All the houses facing the river and many in the High Street were flooded, causing damage to carpets and furniture, and below the town the tide flowed over the top of the sea-wall like a waterfall, many acres of land being flooded. This gradual working of the water in the end weakened the wall, and just above the sewage tanks made a breach, through which the tide continued to flow for a long time.

At Wallasea many breaches were caused in the walls, and more than three parts of the island, which contains about 3,000 acres, was under water. Many exciting scenes and very narrow escapes from drowning are recorded. The Southend road was submerged to a depth of four feet.

The same story applies to Fowlness. Here on the sea-side, a greater part of the sea-wall on Rugwood's Farm to Fisherman's Head, the terminus of the road over the sands to Wakering, was washed away and the eastern portion of the island was flooded. The smaller islands, Potton, New England, Havengore and Rushley, suffered still more seriously, the breaches in the sea-walls being in some cases so deep that the water could flow in and out at an ordinary tide. This was especially the case at New England, where on the Shelford Creek side an enormous breach was made. Between

60 and 70 sheep were drowned. The earth from this breach was so washed over as to destroy a valuable oyster-laying in the Creeks. Bridgemarsh, an island situated on the north bank of the Crouch, was completely obliterated for a time, no trace of the land or sea-wall being visible. The inhabitants were rescued in boats, but many sheep were drowned. In many places the sea-walls of the Crouch were destroyed and the adjacent lands flooded; perhaps the worst breach being at Eastlands Farm, Bradwell. Here about 60 acres were recovered from the sea some 30 or 40 years ago, a new sea-wall, 150 yards in extent, being put up. This new embankment was washed away bodily, and the water, rushing in, carried with it light barley stacks, which it floated to the old wall and left them there almost as shapely as when they started on their voyage.

It would be tedious to recount all the damage done to lands and property adjacent to the Thames. Shoeburyness and district suffered severely, the water getting into the Cambridge Hotel, and the whole place was one sheet of water—about 200 acres being covered. The street was full of boats which were rowed up and down. At Great Wakering many farms were completely covered. The flood reached Wakering Church, and stood two or three feet deep in the roads and houses, the people retreating to the upper rooms. At Southend, a considerable part of the District known as the Lower Town was flooded and very great damage was done. This would have been increased but for the fact that there was hardly any "sea" at the time of the abnormal tide. At Leigh the water flowed over the High Street and into the houses. Boats were sailed up the street, and an eight-oared boat was rowed up. Between Benfleet and Pitsea, the ballast and other supporters of the down metals on the railway were washed away for about two miles, and the whole of the line flooded for that distance. The Bowers and Pitsea Marshes were overflowed, the sea-wall having given way in many places; at Casey Farm, there were no less than 15 breaches. Mr. Williams reports that he saw a couple of hawks at work, no doubt capturing mice and moles which made for the uplands in great numbers. From the Vicarage-hill at Benfleet, one could see seven or eight miles of flooded land, extending from Canvey to Fobbing Marshes. Canvey was half submerged, breaches being forced in the walls, of which together about 1,000 yards were destroyed. A house-boat occupied by a "Winkler," was carried right away over the Marshes and turned completely upside-down. The "Lobster Smack" Inn was unroofed.

All along "London's River," at Stanford-le-Hope, Tilbury, Grays, Purfleet, Rainham, Barking, &c., the water over-flowed, and thousands of feet of river walls were damaged or destroyed. At Tilbury the water was in places quite six feet deep. Even as near London as West Ham and Stratford the water in the Creeks and the Lea River poured over the banks, and covered the streets.

To use the words of Mr. W. Jaffrey, the Surveyor appointed by the Dengie Levels Commissioners to report to them, the tide would not have been exceptionally high had there been no *wind*. The wind blew on Sunday evening from the south-west and swept the waters heavily down the English Channel. Then the wind changed, and on the Monday swept the waters up from the North Sea. The waters were consequently blown in two directions and heaped up together, and when forced up the estuaries, accomplished the devastations we have recorded.

The above will serve as a record of this remarkable flood, and of the extent and nature of the damage. Very many details are omitted to avoid undue prolixity. Large gangs of men were speedily employed in repairing the sea-walls in some places—but in others it will not pay the owners to do so, and in the absence of Government assistance a very considerable quantity of land will be allowed to revert permanently to the sea. At the time of writing we understand that the owners of New England Island, by Fowlness, have decided not to proceed with the work of repairing the sea-wall. The damage done here is noticed at page 280 above. Since the great tide the owners have spent nearly a thousand pounds in renewing the wall, but time after time the new work has been washed away. As a probable result of the stoppage of the work, the island will become a large "salting," even if eventually it does not altogether disappear under the ceaseless action of the waves.

Very serious considerations, from the point of view of the farmer, are the effects that the sea-water may have on the fertility of the flooded lands. Our member, Mr. T. S. Dymond, F.I.C., Staff-Chemist to the County Council, has published a valuable report on this aspect of the case.[1] He says that upon some of the farms "the water drained off in about six hours; upon others it remained for 24 hours, others again were flooded for six or eight days. In another district the water remained for eight weeks, while in some the land has been flooded continuously ever since." Mr. Dymond states that the water of the North Sea contains 2·7 per cent. of sodium chloride and about .5 per cent. of other chlorides and sulphates. Of these common salt is the constituent likely to be injurious to crops, and its quantity is sufficient to produce plasmolysis of the root-hairs (*i.e.* shrinkage of the contents of the cells), and therefore serious damage to plants. Peas and tares suffered severely even where the land was only flooded for a few hours; wheat was damaged to a smaller extent, but permanent pasture appeared to sustain no very appreciable injury.

With reference to the probable effect on future crops,

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[1] *Report upon the damage on Agricultural Land caused by the Salt-water Flood of November 29th, 1897, with suggestions for future cultivation.* By T. S. Dymond. The Essex Technical Instruction Committee, Feb., 1898.

Mr. Dymond gives a table of analyses made with the assistance of Mr. F. Hughes, F.C.S., of samples of soil obtained from six of the flooded lands in Essex. These show that whereas unflooded land contained about ·01 per cent. of salt, the flooded land contained on an average about ·2 per cent. in the surface soil. Now, ·2 per cent. in the top six inches of soil is equal to 40 cwts. per acre, which, if applied as a top dressing, would undoubtedly be injurious to growing crops, but if diffused throughout the first six inches a much larger quantity would have little or no effect. It is not, therefore, the direct injury to the roots of plants that has to be considered, so much as injury to the condition of the soil. It is noticeable that upon land where *earth-worms* were abundant, they entirely disappeared from the flooded portions, and after the flood the worms were found strewn upon the ground and were quickly picked up by gulls. "The use of worms in heavy land," Mr. Dymond remarks, "in assisting the drainage and thus promoting aeration of the soil is universally recognised, and their extermination in the heavy land is a most serious matter." Further, the chlorides of magnesium and calcium contained in sea-water, by their power of absorbing moisture from the air, would render the soil wet and difficult to work. The only practical means of eliminating the salt suggested, is to take advantage of the rainfall and by encouraging rapid drainage. From an experiment made it was found that 1¾ inches of rain-water when allowed to filter through six inches of the soil from the flooded arable land at Wallasea, was more than sufficient to remove almost every trace of salt. Mr. Dymond's pamphlet is well deserving attention, and the investigation is a note-worthy example of scientific method in the examination of an interesting agricultural problem.

The great flood of November, 1897, will long leave traces on our coast, and beyond the mere historic interest which it possessed, the consideration of its effects is of some scientific importance, inasmuch as it proved how readily changes in the coast line may be produced, and that the work of man in embanking and draining of land, which took years to accomplish, may be destroyed in an afternoon. Changes in the maritime and riparian fauna and flora of the flooded districts may have also to be numbered with the permanent effects of this abnormal tide, and it would be an interesting task to make researches in this direction. Reference should be made to Mr. Clark's article in the succeeding part of the ESSEX NATURALIST.

NOTES ON THE CONFERENCE OF DELEGATES OF THE CORRESPONDING SOCIETIES OF THE BRITISH ASSOCIATION, TORONTO, 1897.

[*Compiled by the Editor.*]

MR. T. V. Holmes, the Secretary to the Conference, who has for the last few years acted as the Delegate of the Essex Field Club, was unable to go to Canada with the Association, and Prof. Meldola, F.R.S., acted in that capacity. Prof. Meldola gave a brief verbal report of the proceedings of the Conference at our meeting on December 11th last (*ante* p. 232), but in continuation of the series of notices of the proceedings which have appeared regularly in the publications of the Club since the establishment of these Conferences in August, 1882, it may be well to print here a few notes of the Toronto Conference.

The first meeting was held in the University on August 19th, Prof. Meldola being Chairman, with Mr. J. Hopkinson, F.L.S., as Secretary.

The first subject brought up for discussion was the Report on the scheme for Federation of Local Societies suggested by Mr. Abbott at the Liverpool Meeting the previous year. This matter has been somewhat fully explained by Mr. Holmes and Prof. Boulger in papers printed in the ESSEX NATURALIST,[1] and consequently a few words only are needed here to show the present position of the question. In answer to the circular requesting opinions on the scheme, which was sent to 66 Corresponding Societies and to 58 others, only 34 replies were received. These may be classified thus:—

Belong to Unions already	9	
In close touch with a Union	1	
Prevented by circumstances from joining Unions	2	
Undecided	4	
Generally favourable to Unions	9	
Unfavourable in their own cases	9	
	—	34

The Report comments on this list as follows:—

"The two Societies prevented by circumstances from joining Unions are the Cambridge Philosophical Society and the Marlborough College Natural History Society. In the replies from the four Societies classed as

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[1] Mr. Holmes' Report as Delegate, E.N., vol. XI., pp. 236-241; Prof. Boulger's paper, "The Federation Ideal for Natural History Societies, with special reference to the Eastern Counties." E.N., vol. X., pp. 51-55.

'undecided,' perhaps the most significant remark is to the effect that the Club in question is doubtful whether economy of energy might not be dearly purchased by loss of enthusiasm, and whether 'a deadening uniformity' might not result from Unions. Of the nine Societies generally favourable to Unions, two only, the Hertfordshire Natural History Society and the Leicester Literary and Philosophical Society, sent definite, detailed plans of what they proposed to accomplish in their own localities. And a third, the Essex Field Club, stated that it was in communication with the Norfolk and Norwich Natural History Society with the view of establishing some degree of co-operation between the two Societies in the future. The others contented themselves with the remark that union was a step in the right direction, or with some other phrase expressing vague approval."

"The replies received from the Societies classed as 'unfavourable in their own cases' vary very much as to their approval of federation in the abstract. All these Societies are Corresponding Societies, and have counties or other large areas as their spheres of work."

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"Judging from answers received, it would appear that Societies having a whole county or some district of similar size as their sphere of operations are usually indifferent, or averse, to union with adjacent counties or districts. Members of such Societies do not generally feel a strong local interest in larger areas, and at the same time they do not need the help of other Societies in the publication of their transactions. On the other hand, experience shows that a large number of the smaller local Societies are associations rather for lectures and excursions than for local scientific work, and the brief annual reports they issue are of little interest, except to their own members. Consequently they also are uninterested in questions about federation."

After discussing the probable causes of failure of some recent attempts at federation, notably the "Midland Naturalists Union" and the "Cumberland and Westmorland Association," the Report concludes :—

"In short, while no one can doubt the great desirability on all grounds of increased federation among various local Societies, it is obvious that success must depend, not on the abstract merits of any given scheme, but on its suitability to the local conditions in which it is expected to work. Some disappointment may be felt at the slightness of the interest manifested in federation. But it may be hoped that many Societies which are more or less averse to any close federation with neighbouring Associations have, nevertheless, had their thoughts profitably directed towards the attainment of a much greater amount of mutual co-operation and assistance than at present prevails."

An interesting discussion took place, which is too long to report fully here. The Chairman, while admitting the great differences of opinion with regard to federation, thought that much good might result from some such scheme as the grouping of Counties for occasional meetings of their Local Societies, if for no other purpose than to avoid duplication of work.

Prof. Herdman discussed the difficulties of the question, and said that, as a matter of history, every attempt at federation made by the Liverpool Geological and Biological Societies had ended in failure. Office-bearers in active Societies of good standing were, as a rule, opposed to federation, and if there were one subscription to federated Societies the income of each individual Society would be reduced. Dr. R. H. Mill, on the other hand, stated that the "East of Scotland Union of Naturalists' Societies" was very successful, and that the Perthshire Society of Natural Science was one of the best of these Local Societies, its Museum being one of the sights of Perth. These Societies meet in different towns each year, have joint excursions, and are so satisfactorily related as to give him great faith in the importance of union. He thought there should be a better result from the action of the Corresponding Societies Committee than from any other agency, and wished that some stronger action had been taken than was indicated in its Report.

Other speakers urged that there would be a difficulty in carrying the idea out, many Societies fancying that they would lose more or less of their identity in union. Mr. Hopkinson, on the contrary, argued that federation did not imply sacrifice of individuality.

The general impression imparted by the discussion to our mind is, that the question of federation is not so simple nor are plans for its adoption so easily to be carried out as some writers and speakers would contend. In our opinion the best results would be obtained by the establishment of a really strong society in each county or larger district, and occasional meetings for discussion and promotion of unity of action between neighbouring societies, or those pursuing a certain line of work. Most active societies suffer rather from a lack of funds necessary for carrying on investigations which they know to be necessary, than from ignorance of what should be done. If county people would adequately support their own scientific and antiquarian local societies, plenty of good work would be accomplished, and the various and somewhat bewildering suggestions put forward for the guidance of societies would stand a chance of being considered and acted upon, instead of suffering neglect from the sheer want of the funds often absolutely necessary for carrying on continuous and systematic investigations.

At the second day's Conference, Prof. Miall made some most interesting and suggestive remarks on the study of life-histories of insects as an introduction to natural history, a subject which is too much neglected by even professed naturalists. Mr. Miall announced that he had in preparation a "life history" of the gnat *Chironomus* as an exemplification of the methods he advocated, and all who have read his books noticed in a former part, (E.N., vol. X., p. 57), will look forward to its publication as to a biological feast.

Dr. Ami read a paper "On the state of some of the Principal Museums of Canada and Newfoundland" which has been printed in full in the last Report (1897) of the British Association, pp. 62-74. In the discussion of this paper the Chairman said that Englishmen must feel regret that the Museum question is not taken up with more earnestness in their own country. Their provincial museums only existed with much difficulty, and were altogether dependent upon private bounty in carrying on their existence. Anyone who visits many of the local Museums in England must see that the Museum question has not taken that prominent part in public opinion which it ought to do. Mr. Hopkinson remarked that he was specially interested in the Museum question at the present time, for, with other members of the Hertfordshire Natural History Society he was now endeavouring to raise sufficient money to build and endow a Museum for Hertfordshire, for which Earl Spencer had granted an ample site at St. Albans. They had already been promised about £1,500, but had decided not to commence building until £2,000 had been raised. A temporary Museum had been opened at St. Albans, and he felt sure, from their success in obtaining objects of local interest for it, that if the money required could be raised an interesting and valuable collection would be got together.

And finally Prof. Haddon speaking on behalf of the Ethnographic Survey Committee urged local societies to undertake a survey of the ethnography of their own districts. He would be sorry to draw students away from the study of other branches of natural history, but he thought that there must be many members of Local Societies who did not study the fauna, the flora, or the geology of their locality, but would be interested in ethnographical work of some kind. There are several anthropological investigations which could be attempted almost anywhere. Besides observations on the colour of the hair and eyes, the stature, the shape of the head, and other physical characters, the customs and beliefs of the people and their folk-lore should be studied. As examples, mention need only be made of local customs on particular days, or the numerous and very interesting singing games of children, such as 'Jenny Jo,' 'Dukes-a-riding,' 'Green Gravel,' and the like. These might seem to be trifling matters, but many such customs and games are the only records we have left to us of the religious rites and social customs of our ancestors, and therefore they are by no means to be despised. It would also be advisable for the local scientific and photographic Societies to interest their members in depicting the geology, natural history, and ethnology of their district, the latter especially. Many opportunities for the study of British anthropology are vanishing or becoming modified, just as surely as are corresponding details in the islands of the Pacific.

As indicated above (*ante* p. 248) the Essex Field Club is credited in the Index appended to the Report under consideration, with 24 papers relating to local scientific investigations published in the ESSEX NATURALIST during the year ended June 1st, 1897.

ON A MANUSCRIPT OF THE LATE JOHN BROWN, F.G.S., OF STANWAY.

By A. S. KENNARD AND B. B. WOODWARD, F.L.S., F.G.S.

[*Read February 26th, 1898.*]

AN excellent account, with a portrait, of the life and work of this Essex worthy was published in the ESSEX NATURALIST, vol. IV., pp. 108-168. In it the author, Mr. Alfred P. Wire, stated that the story of John Brown's life was very fragmentary and imperfect, and it is to be regretted that we can add nothing in that direction.[1] But as regards his work, there is now in the Library of the British Museum (Natural History) a notebook of Mr. Brown's that is of great interest to all members of the Essex Field Club. It consists of 86 pages, on the first of which there is an index as well as a foot-note by the late Sir Richard Owen, "Memoranda on Fresh-water Deposits 1842-3 by John Brown, Esq., F.G.S., of Stanway, Essex." The earliest date in the book is 1841 and the latest August, 1859. Since Mr. Brown died in November, 1859, there is no doubt that we have here the geological notes made during the latter part of his life, and judging by internal evidence the book was probably commenced about 1850 and the earlier entries copied into it. One of the most interesting features is a list of his correspondents, and we find there the names of Professor Owen, Professor Tennant, Dr. Falconer, Dr. Edwin Lankester, Mr. G. B. Sowerby, Mr. S. V. Wood, Mr. E. Charlesworth, Mr. John Moore, Mr. S. Stuchbury, Mr. John Pickering, Mr. J. W. Flower, and many others who may well be styled "the early fathers of English geology." No mention is made of Copford, Beaumont, or Grays, but with these exceptions, this book contains the materials on which his scientific papers have been founded, so that there is no need of an extended notice. Of great interest is a catalogue of 163 bones and teeth of mammalia from the Pleistocene of Clacton, and Mr. Brown added that "this list is copied from Mr. Waterhouse's notes taken by that gentleman at the time he came to convey the collection to the British Museum in August, 1852."

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[1] A few additional particulars of John Brown, from the *Life of Richard Owen*, are given in the ESSEX NATURALIST, vol. ix., p. 263.—ED.

There is also a list of the "bones found with Roman Pottery, All Saints, Colchester, 1852," and a further one of "bones and teeth found on Mr. Tabor's garden with Roman Pottery in 1850. St. Mary-at-Walls, Colchester."

As may be expected, the larger proportion of the notes are on the Post-Pliocene beds of Essex. Lists of the Mollusca from Raine, Clacton, and Witham are given, and, in the latter case, a list by Mr. Pickering has been inserted. In our paper on "The Post-Pliocene Non-Marine Mollusca of Essex" (*ante* p. 92) we have recorded *Paludestrina ventrosa* from the latter locality. Examples of this species labelled "Witham" are in the Natural History Museum, but it is not given in Mr. Brown's list. It is a brackish-water form, and, as we pointed out, its occurrence in an inland locality is noteworthy. Moreover, it is not likely to be confounded with any other species in the list, consequently we think it possible that an error as to the locality of these specimens may have been made.

On page 68 of the M.S. is the following note:—

> "1856, January 2nd. In an excavation three feet deep at the back of the house in the garden near the kitchen window, I this [day] placed a live toad under a flower pot. At the same time and at the same depth from the surface I placed a small toad, apparently in size about two years old, in an excavation in the drying ground and marked both the spots."

"March 23rd [1857]. I this day disinterred the toad on the drying ground in the garden, found it alive and apparently quite well after being buried 13 months, 3 weeks, and 2 days."

The numerous sections given (nearly all of which are now things of the past) are characterized by the minute and careful observation for which Mr. Brown was noted, and would well serve as models for modern workers. There are many other points of minor interest in the manuscript, but this note has been written more for the purpose of calling the attention of Essex naturalists to the book than for giving a detailed account of its contents.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Badgers *(Meles taxus)* at South Ockendon and Billericay.—According to the local newspapers, in the last week of March, a very fine dog Badger was captured by some men who were rabbiting in Bonnykit Shaw, in the occupation of Mr. Richard Manning, of Little Belhus, South Ockendon. We have been unable to obtain any more definite information, two inquiries addressed to Mr. Manning not having resulted in any response.

In November 1895, we received notice of the occurrence of a Badger at Billericay, from General B. R. Branfill, which unfortunately escaped record at the time. It was a fine female, weighing about 29-lbs. and was found lying on the railway, 200 to 300 yards east of Billericay Railway Station, on November 16th. It was dead but quite warm when found at 7 o'clock by two workmen on the line (W. Candler and — Halls), and was almost cut in two, as if it had been run over by the previous train. The skin was sent to Mr. Wilson of the G. E. R. General Branfill added "no badgers are known to have been hereabouts for many years past."

Polecats in Suffolk.—The Polecat (*Mustela putorius*) is unfortunately by continued persecution becoming so rare in the Eastern Counties that Lieut.-Col. Butler's (Brettenham, Park, Ipswich) record in the *Field* is worth quoting. "I have just examined two polecats that were lately killed in Suffolk; one at Cavenham Hall, about six miles north-west of Bury St. Edmunds, on Feb. 3rd, and the other near Mildenhall, about ten miles north-west of the same town, on the 15th idem. Both were males in beautiful winter coat, and have been preserved by Mr. Travis, taxidermist, Bury St. Edmunds." The Rev. J. G. Tuck, Bury St. Edmunds, records in *Zoologist* for January another Polecat killed about Dec. 20th, near Mildenhall Fen. He adds "in our neighbourhood these animals are now very rare, but they still exist in some numbers in the Fen country, where the voles, frogs and eels provide them with an abudance of prey. The *Zoologist* for 1888 (pp. 183, 221), contains some interesting information on the subject of Suffolk Polecats."

Seals on the Essex Coast.—In addition to the example recorded by Mr. Fitch in the last part (*ante* p. 234) from the Crouch river, several other seals have recently been seen on the Essex Coast. But as Dr. Laver remarks in the *Mammals, &c., of Essex* (p. 57) there is generally great doubt as to the species, the animals not having been examined by naturalists, and in the present cases all efforts to obtain further information have been unavailing. According to the *Essex County Standard* on Christmas Eve (Dec. 24th) "A fine specimen of the 'Grey Seal' (?) was shot in the River Stour, just opposite Mistley Place, by Mr. Chas. Porter, one of the local puntsmen. It is stated that about 45 years ago a pilot named Eteen secured one of the brown species."

In spite of this definite statement, Dr. Laver is of opinion that the animal was not the true Grey Seal (*Halichærus gryphus*) but that it, and the two following, would properly be referred to the Common Seal (*Phoca vitulina*).

On February 12th, according to the *Essex County Chronicle*, the men employed by the Roach River Oyster Company were returning home in the sailing boat 'Choice' when they noticed a seal disporting itself in the Branklet reach of the river Roach by Wallasea Island. A gun was immediately produced, and William Bridge succeeded in shooting the mammal. The men rowed in the same boat to secure their booty, but just as they came up to it the seal sank.

The *Evening News* of March 2nd, under the heading "Seal Hunt in the Thames," gives the following narrative:—"Much excitement was caused at Grays, a correspondent reports, by the appearance of a seal on the mud opposite the training ship, 'Exmouth,' seemingly making frantic efforts to reach the water. Several boats from the ship put off to try and capture the creature, which seemed tired out. The men expected no trouble in their undertaking, but as the boat approached it, the seal dashed with the speed of the wind into the water, and after giving the boats a little chase, finally dived and disappeared, to the great disappointment of the ship's boys who were eagerly watching the chase."

A "seal" is reported to have been shot in the Althorne Creek, Crouch River, after the flood on November 29th last, but no further particulars were obtainable.

And finally, Mr. Matthams states (*in litt.*) that Seals have been more than once taken in the Kiddle nets at Fowlness Island, and that one was sent alive to Southend some years ago.

We suppose, as sad experience seems to teach, it is quite useless protesting against this wanton destruction of harmless animal life which so constantly goes on. Otters, badgers, seals, and other interesting creatures are ruthlessly destroyed at sight by gentle and simple alike. Although we fear the pleasing anticipations of the writer would not have been realized, all will agree with the spirit of the remarks in the *Chronicle* anent the river Roach seal: "If the seal had been captured the men who secured it would no doubt have made a little out of it, but how much more would people make if, by allowing one treasure to remain, [illegible] to come. If Burnham could only persuade the [illegible] be "made" in the twinkling [illegible] disporting himself would alone be sufficient to draw visitors by the thousand. But such a thing can never be, we are afraid, while our present system prevails."

Number of Deer in Epping Forest.—Since the census of the Deer in Epping Forest on April 30th, 1896, recorded in the ESSEX NATURALIST (*ante* p. 59) another estimation has been made by the order of the Epping Forest Committee. In the Report of the Committee for 1897 it is stated that "on the morning of the 24th March, 1897, there were counted 206 Fallow and 25 Roe Deer, and in the evening of the same day 199 Fallow and 21 Roe Deer." This shows a very satisfactory increase in the forest herds of fallows, and it is particularly pleasing to record that the pretty little Roe Deer are also fulfilling the divine command to increase and multiply.

PISCES.

Mackerel *(Scomber scomber, L.)* **in the Crouch River.**—According to a report in the *Essex County Chronicle* of the high tide on November 29th, a specimen of the Mackerel was caught after the flood at Battles Bridge, presumably forced up the river by the incoming flood. The occurrence is not authenticated by any naturalist, but it may be worth noting, as the fish is very seldom seen on our Coast.

Salmon, Sea Trout, Sturgeon, and Halibut off Fowlness Island.—In a letter to Dr. Laver, Mr. H. L. Matthams says that Salmon (*Salmo salar*) are more frequent off the coast of Fowlness than is generally known. Few years pass without young fish being captured in the "Keedles" ("Kiddles" or "Kettles," fixed seines or weirs for taking fish). They are mostly small, from two to six pounds. He also reports that now and again a Sea Trout (*Salmo trutta*) is taken. Within his own knowledge also, the Kiddles have intercepted during the last few years, in addition to the ordinary fish, Sturgeon (*Acipenser sturio*) and Halibut (*Hippoglossus vulgaris*). This last is an addition to the Essex fish list; it is not recorded in Laver's *Mammals, Fishes, &c., of Essex*, and Dr. Laver writes that he has never seen a Halibut taken on the Essex coast. The fish usually lives in rather deeper water; it is frequent on the Dogger-Bank, and great quantities are taken in the Norwegian seas.

Large Pike (*Esox lucius*) **in the Lea River.**—Mr. W. G. Ganatt, of "Walton Lodge," Hertford, writes to the *Field* that on March 11th he took from the Lea a Pike of 24lb. weight and 40½ inches long.

AVES.

The Heronry in Wanstead Park.—You may like to know that there are 50 effective Herons' nests in Wanstead Park this spring as against 48 last year. Their rivals, the rooks, have greatly mutiplied, there being 430 nests on the Heronry Island this year, an increase of about 10 per cent. on last season. On the 1st March the keeper thought he could hear young herons chirping. I was very sceptical, but the next day he found the broken eggs on the ground. The young birds can now, on April 1st, fly from tree to tree. This is unusually early.—E. N. BUXTON, "Knighton," Buckhurst Hill, April 3rd, 1898.

Mortality amongst young Wild Ducks.—A writer in the "Field" of April 30th states that "an Essex Duck-shooter of many seasons' experience recently let fall a remark respecting a somewhat curious belief prevalent in certain quarters. It is to the effect that young wild ducks hatched in May are seldom reared, as, to use his words, 'they turn on their backs and die.' It is plain that some ground exists for such belief, for the sportsman referred to asserts that he himself had seen hundreds of newly-hatched ducks lying dead in May. Possibly this may be a fact well known to some, and one that is easily accounted for. Can the mortality be accounted for by the fact that the increase of temperature usually experienced about May is inimical to young duck life? The majority of the wild ducks seen in this country are reared in a climate far less temperate than ours; thus it is not unreasonable to infer that young wild ducks thrive best in an atmosphere several degrees lower than 60 Fahr., a shade temperature often enough reached in this country at the beginning of May. Or, on the other hand, it might be that the direct action of the sun's rays, often extremely powerful at this season, may alone be accountable for the injury."

"Another Essex Decoy" (*ante* page 234).—In the note under the foregoing heading my list of Field-Names is quoted as furnishing, as one of them, 'Decoy Pond *Mill*.' Reference to the original list, as printed, shows that this should be 'Decoy Pond *Field*'—the form cited lower down by the Rev. W. H. Lowder. While making this slight correction, I take the opportunity of thanking Mr. E. A. Fitch for his kind reference to my articles.—W. C. WALLER, Loughton.

Spotted Crake (*Porzana maruetta*, Leach) in the Lea Valley (*ante* p. 235). In 1891 a pair bred near "Dobbs Weir," Roydon, on the River Lea. During June and July, I frequently observed the young brood, five in number, and in the month of August (as recorded in my former note on page 235), three of these birds were observed.—E. JERRARD WILLS, "Snows," Nazeing.

Terms used by Wildfowlers.—The *Field* gives an interesting list of the words used by Wildfowlers in describing gatherings of birds:—A *herd* or *team* of swans; a *gaggle* of geese (when settled on land or water); a *skein* of geese (when on the wing); a *paddling* of wild ducks (on the water); a *team* of wild ducks (when flying); a *sord* or *suit* of mallards; a *company* of wigeon; a *flight* or *rush* of pochards; a *spring* of teal; a *coil* of teal (in East Anglia); a *dopping* of sheldrakes; a *herd* of curlews; a *sedge* of heron; a *covert* of coots; a *congregation* or *wing* of plover; a *wisp* of snipe; a *fling* or *cloud* of dunlin (when on the wing); a *hill* of ruffs.

Wildfowlers usually speak of a small number of wildfowl—more particularly when on the wing—as a *trip*. A little gathering of wigeon, pochard, teal, and other of the smaller ducks and of shore birds is generally referred to as a *bunch* or a *little knob*.

Spring Arrivals of Birds.—*Swallows.*—The Rev. HENRY HASTED writes from the Rectory, Pitsea:—"This morning (April 8th) I saw a *swallow* in my garden. My servant also saw it. I am inclined to think that its appearance is unusually early in this part of the world. I have never seen one so early, although I will allow it is possible that it might have been seen on the Marshes." "I and my brothers saw a *swallow* at West Mersea on the morning of April 12th last," W. COLE. Mr. E. JERRARD WILLS writes that he saw the *Corn Crake* at Nazeing on April 12th; the *Wryneck (Iynx torquilla)* on April 13th; *Martins* on April 13th; and *Cuckoo* on April 15th evening, and several on the morning of the 16th. "I heard the *Nightingale* at Tiptree Heath on the morning of April 16th," H. A. COLE. The *Cuckoo* was heard in Lord's Bushes, Epping Forest, on April 18th, by Miss JANE COLE

INSECTA.

LEPIDOPTERA.

Abundance of *Pieris brassicæ*.—One noteworthy fact this spring has been the abundance of the handsome "Large White Butterfly." Dozens at a time have been seen in the lanes and fields, and even in the depths of the forest it has been the commonest butterfly. The fine insect has invaded the streets of London, and has furnished the "penny-a-liners" with startling "copy." The extraordinary fluctuations of the occurrence of this insect are doubtless connected with its migratory habits, of which an example at Harwich was recorded in the ESSEX NATURALIST, vol. vi., p. 205.

Amphydasis prodromaria **in February.**—I was surprised to find a male "Oak Beauty" at rest on a trunk in Lodge Bushes, Epping Forest, on February 11th. Surely an extremely early exit from the pupa.—W. COLE, Buckhurst Hill.

MISCELLANEA.

Col. Mudge's Map of Essex.—Referring to Mr. Avery's enquiry respecting this Map at the Meeting on February 26th last (*ante* p. 255), Mr. Walter Crouch gives some details of this early Ordnance issue:—"The chief feature of interest lies in the fact that the map was produced by a more perfect Ordnance Trigonometrical survey, and is, therefore, far more correct than any of the earlier maps, not omitting even that fine large-scale survey (two inches to each mile) made by Chapman and André, the original edition of which was published in 1777, and the second edition in 1785, the latter bearing the name 'Keymer,' of Colchester, who had purchased the plates. Although one can scarcely call Mudge's map a common one, it is not so rare, I think, as many have supposed; I have seen and noted more than half-a-dozen copies.

'For notices of many of the Mudge family, *vide The Dict. of National Biography*, vol. xxxix., pp. 254-262. Col. Mudge, F.R.S., who was born in 1762, was a godson of Dr. Johnson, and it is to this mathematical mapmaker that Wordsworth alludes in his poem on 'Black Combe', written 1813. The doctrine of heredity gains strength from the fact that his father, Dr. John Mudge, F.R.S., was not only a skilled physician, but learned in the construction of telescopes, and in 1777 won the Copley medal of the Royal Society for the composition and grinding of a true parabolic speculum for these instruments; while his grandfather, the Rev. Zachariah Mudge, Prebend of Exeter, was painted three times by his friend, Sir Joshua Reynolds, who spoke of him 'as the wisest man he had met in his life,' and whose obituary and character were penned by Dr. Johnson.

The following gives the title and description of the map .—

'Part the first/ of the/ General Survey of England and Wales/ containing the whole of/ Essex/ and a portion of the adjoining Counties/ Done by the/ Surveyors of His Majesty's Ordnance under the direction of/ Lt.-Col. Mudge, of/ the Royal Artillery, F.R.S. Published April 18, 1805, by Lt.-Col. Mudge, Tower.'

"The size of this map is in width 72 inches and in height 47½ inches; while the scale is one inch to the mile. The portion of the adjoining counties includes—on the north, Bassingbourne (Royston), Herts, to Orford Ness, Suffolk; on the south, Sydenham, to the Isle of Grain, Kent; on the west, Dulwich Wood, through Stoke Newington, Middlesex, to Bassingbourne."

Fairmead Lodge.—As pendant to a note on this subject which appeared a year or two ago (E. N. Vol. viii. 1894, pp. 158-9) the following extract from a review of the new edition of Lord Byron's Works (J. Murray, 1898), may not be unwelcome. Speaking of the notes by the Editor, a reviewer in the *Standard*, April 20th, 1898, says:—'Here is another note on a bygone man of letters, whom Byron ranks with Gifford and MacNeil, as superior to Scott and Wordsworth:—

"William Sotheby (1757-1833) began life as a Cavalry officer, but being a man of fortune, sold out of the Army and devoted himself to literature, and to the patronage of men of letters. His translation of the 'Oberon' appeared in 1798, and of the 'Georgics' in 1800. 'Saul' was published in 1807. When Byron was in Venice, he conceived a dislike to Sotheby, in the belief that he had made an anonymous attack on some of his works; but, later, his verdict was, 'a good man, rhymes well (if not wisely); but is a bore (' Diary,' 1821; 'Works,' p. 509, note). 'He is the solemn antique man of rhyme' ('Beppo,' st. lxii.), and the 'Botherby' of 'The Blues'; and in 'Don Juan,' Canto I. st. cxvi., we read—

"'Thou shalt not covet Mr. Sotheby's house
His Pegasus nor anything that's his.'"

Sotheby was an elegant *littérateur*, one of the frequenters of Murray's parlour, a worthy companion of the "wits," but with no pretensions to the character of a true poet."—W. C. WALLER, F.S.A., Loughton.

[We are sorry to say that the existence of what remains of Fairmead Lodge is now threatened, owing to the bad state of the structure. The outbuildings. &c., have already been removed, and the garden-ground levelled and thrown into the forest. Rumours are current that the Conservators have decided to wholly remove the building, but the only official information is that given in the Report of the Epping Forest Committee for 1897, to the following effect:—"Fairmead Lodge and about eleven acres of land were acquired by the Conservators in the year 1882, in exchange for outlying portions of the Forest. The property was then in the occupation of Mr. Edward Bartholomew. Having regard to the fact that he had been occupier for many years, and catered for Sunday Schools and other excursionists, we deemed it advisable to make an arrangement with him by which he became our tenant of the house and about 2½ acres of land only, at a rent of £63 per annum, the remainder of the land being thrown into the Forest. The house is very old, and its condition gradually became very dilapidated, but we were reluctant to disturb Mr.

Bartholomew (who was an aged man) in his occupation of the Lodge. He died about Michaelmas last, and we have since resumed possession of the property and thrown the 2½ acres of land into the Forest. Most of the outbuildings are in a very ruinous and insanitary condition, and will be entirely cleared away, but we have instructed Mr. Surveyor to consider whether it is possible to adapt the house, or any portion of it, for a keeper's residence."

Visitors to the Forest will regret the disappearance of an ancient landmark, but if the house is too far gone to allow of repairs nothing can be said, and, undoubtedly, its removal will add greatly to the quietude and seclusion of that section of the woodlands.[1] — Ed.]

Boring for Coal in Essex.—As a matter of scientific interest, we regret to announce that the third experimental boring at Great Wakering, Essex, which was alluded to in the article in the present volume (*ante* pp. 136-139) will in all probability not be carried out. The Directors of the Eastern Counties' Coal Boring Association have issued a notice to the shareholders that inasmuch as sufficient funds for the third boring have not been subscribed, they recommend that the Association should go into voluntary liquidation. The cost of the experience gained has been £4,829 19s. 11d., of which £492 went in preliminary expenses; £1,645 on the Stutton contract; £1,132 on the Weeley contract; and nearly £300 for the current expenditure for four years, leaving a balance in hand amounting, with interest, to £1,275. The Directors consider that about £700 more would be required, and up to the present time this money has not been obtained. Should the Association be wound up, there will probably be an end of boring for coal in East Anglia for another generation. It is certainly unfortunate that this third experiment should, for lack of only a few hundred pounds, be unmade, especially as two-thirds of the total sum required stands to the credit of the Association. Possibly the shareholders will yet reconsider the matter before it is too late.

The Essex Hailstorm Relief Fund.—As a sequel to the story of the great storm given at length on pp. 112-128, we may quote a few figures from the final report which has now been presented to a meeting of the Fund. The statement shows that a total sum of £45,753 15s. 4d. was raised in donations, of which £45,147 4s. 4d. has been given in relief to 3,168 cases, while £564 4s. 11d. has been devoted to general expenses (including an honorarium of £157 10s. to the Honorary Secretary, Mr. F. Whitmore), leaving a balance of £42 6s. 1d. at the bankers. As shown in the balance-sheet, there were over 2,500 cases in which the grants made were under £2. These recipients chiefly consisted of labourers, who had lost their harvest wages, cottage-gardeners and allotment-holders. A resolution was passed expressing thanks to the subscribers and to the Chairman, the Hon. F. C. Petre. The most disastrous storm of modern time so passed into the dim domain of history.

---

[1] Since the above was in type, the *whole* of the Lodge has been pulled down, and the land on which it stood will be thrown back into the forest. The workmen informed us that the building did not appear to be more than 150 or 200 years old, but that some of the oaken timber seemed to be very old and to have been re-mortised when the house was put up—also that many of the old bricks had been chipped and refaced. Their idea was that the house had been built up of the remains of some still older building. A view of the Lodge, with the fine old oak by its side, by Mr. H. A. Cole, will be found in the Essex Naturalist for 1893 (vol. vii., p. 86).

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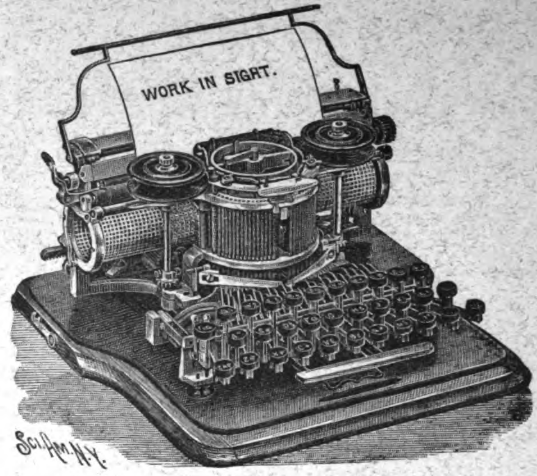
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EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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The authors alone are responsible for the statements and opinions contained in their respective papers.

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MAMMALS, REPTILES, AND FISHES OF ESSEX:

A CONTRIBUTION TO

The Natural History of the County.

(Forming Volume iii. *of the "Special Memoirs" of the Essex Field Club).*

BY

HENRY LAVER, M.R.C.S., F.L.S., F.S.A., etc.,

Of Colchester; Vice-President of the Essex Field Club, and Senior Surgeon to the Essex and Colchester Hospital, Colchester.

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THE ENCROACHING SEA ON THE EAST COAST.

By PERCY CLARK, B.A., CANTAB.

OWING to the widespread destruction by the sea on our East Coast in the late November gale,[1] and a renewal of the same even while I am writing (on March 26th), considerable attention has been drawn to the condition of those parts, and to the nature of the sea defences. As I have spent the last five summers in a small yacht between Aldeburgh in Suffolk and the mouth of the Thames, I have some acquaintance with that very curious seaboard; and a short account of the position of affairs there may be of interest to Essex naturalists.

A large proportion of the coast is marsh land, *reclaimed* from the sea at such an early epoch that little or nothing seems to be known of how and when this was effected. There are exceptions, however, in the case of Canvey Island off Southend, which was enclosed by a Dutchman in the 17th century, and also of some land between the Crouch and the Blackwater, reclaimed by the Rev. Bate Dudley, Rector of Bradwell, about 1780, and also in the case of portions of the Islands at the mouth of the Crouch, which were enclosed by the Earl of Winchilsea at the beginning of this century. A chronological account of the Essex Reclamations would make an interesting study and shed considerable light on the history of the county, and it is to be hoped that some future historian will be found to take up this very much neglected subject.

The landlords who own all these low-lying marshes on the coast now declare that it will no longer pay them to keep up the sea-defences, and have called on the Government to do it in their place; but if it does not pay the owners to protect their own property, it is quite certain the public will not see the force of doing it for them. What the outcome of it all may be if the great tides of this year are repeated it is difficult to foretell, but that a good deal of land will revert into sea saltings such as these marshes originally were is pretty certain. Indeed, much of it has already so reverted.

To describe the encroachments of the sea in these parts, I will begin at Aldeburgh in Suffolk and travel south.

---

[1] Cf. the Report on the High Tide of November 29th, 1897, in the preceding part of the EX NATURALIST, pp. 277-283.—[ED.]

From Aldeburgh to Orfordness Lighthouse (6 miles), which stands on a spit of shingle, the sea is gradually forcing the shingle-beach back over the marshes, and the river Alde, which runs parallel to the sea for 12 miles, will eventually be choked by the shingle bank, which must inevitably, in the course of a few years, be thrust into its channel. A serious state of things will then occur unless a cutting is dug between the river and the sea at Slaughden to allow the former a free exit for its waters. If some strong measures are not taken, Aldeburgh will share the fate of Dunwich, which, owing to a very similar situation, has almost entirely disappeared.

Twelve miles south of Aldeburgh and Slaughden, at the mouth of the river, a slight sea-wall of mud and wooden "shies" alone prevents the heavy seas experienced there from overflowing an immense tract of land by Hollesley, which lies many feet below high water mark. But whether the landlords who own these marshes are prepared to spend a princely fortune in substantial and costly *stone* dykes remains to be seen. A few years more, and they will be too late. South of this again, Sir Cuthbert Quilter has built his fine red brick "Chateau" on the cliffs bordering Bawdsey Ferry, and both he and Mr. Felix Cobbold, at Felixstowe, are doing all they can to protect their respective domains.

Below Felixstowe and Harwich, however, the denudation becomes more marked and serious. Here there are no dwarf cliffs and no shingle to accumulate against the shies. The inadequate sea-walls have fallen in, and in some cases, between Dovercourt and Great Oakley in Essex proper, they have been left to their fate. Two substantial farms have been submerged; and at high water the sea penetrates over the marshes to the foot of the dwarf Essex hills. Old stumps of trees and tops of hedgerows can then be seen far out, just emerging from the shallow water spread around, and the rich pasturing fields are now great stretches of ooze and saltings. I have not learnt the date at which this particular invasion of the sea took place, but it cannot be many years ago, as the dead-hedges still remain.

Close by, in Handford Waters (a ramification of salt estuaries), nearly all the islands have gone in the same way, and the sea is threatening those which are still left. To the naturalist these salt islands are interesting as being resorted to more and more by immense flocks of gulls and other wild fowl.

At Walton-on-the-Naze, the steep Naze, with its commanding landmark, would long ago have been an island, but for the constant exertions of the Waltonians, who have spent large sums of money in keeping up strong defences and stone walls. So far they have successfully averted this dreaded catastrophe.[2]

Thence south to Clacton, the cliffs, though lofty, are gradually being undermined; great landslips continually occur, and the marshes by Great Holland were completely inundated in the tide of November last. In Norden's Map of Essex (1594) this part is marked as an open estuary.[3]

Below Clacton the sea at the same time made a clean breach over the St. Osyth marshes, and Brightlingsea itself actually became an island, an occurrence worth recording, as it is one only once previously known to the inhabitants, and that over 20 years ago.

All up along the course of the Blackwater (15 miles) to Maldon, the same tale is told, and great tracts of land in the Dengie Hundred, presumably those enclosed by the Rev. Bate Dudley, shared a similar submersion.

Further south again, by Burnham-on-Crouch, the islands forming the Essex Archipelago were inundated, and some of the inhabitants were imprisoned by the waters in the upper stories of their farms.

The same account holds good all round by Southend and up the Thames, where even the better built Dutch walls of Canvey Island failed to keep the waters out, and hundreds of acres of land bordering our great river, all along its course to London Bridge, were devastated by the salt waters. Here, however, there are capable authorities to deal with such contingencies, and labour available to strengthen still further the dykes, which must every year be heightened and repaired. But in other parts of the county not so fortunately situated, this invasion of the sea is becoming a very serious matter, and though the naturalist looks with a certain amount of interest on the unequal contest which is continually being waged between sea and land, and notes with pleasure the increased bird life that attends the victories of the former, he would be very callous indeed if he did not also feel much sympathy for the unfortunate owners of the marshes on the Essex coast.

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[2] A short account of the subsidence of a considerable extent of the Cliff at Walton-on-Naze was given in the present volume of the ESSEX NATURALIST (*ante* p. 236).—ED.

[3] Cf. the reproduction of Norden's Map given in the ESSEX NATURALIST, Vol. II. (February, 1887).

FISH-HOOKS OF WOOD USED ON THE ESSEX COAST.

By EDWARD LOVETT.

[Read May 21st, 1898.]

OF all the appliances used by man, perhaps none have undergone so little change or modification as the *Hook* used for catching fish, and yet it possesses an enormous antiquity, and may possibly have even preceded the use of weapons of the chase.

The earliest hooks, of which we have a reliable record, are the Bronze-age hooks of the Swiss Lake Dwellings, but in all probability, fishing-hooks and gorges existed during the Stone-age, and the enormous number of worked flints in our museums labelled "Awls," and "use unknown" seems to point to this. If these flint points are lashed to a wood or bone shank, in the manner in vogue in the South Pacific Islands, a very useful fish-hook is made. When we bear in mind that all, or nearly all, the settlements of man of the Stone-age were near water, we may safely conjecture that, besides the reason for being near to water for drinking purposes, he was in all probability a fisherman, for it is in such localities that I have found these flint flakes to occur.

The investigations of the Swiss Lake Dwelling deposits have brought to light fish-hooks of bone and teeth, and also the first typical barbed fish-hook we know of; it was made from a squared bar of bronze. In form it is the fish-hook of the present day, though, of course, Allcock's fine steel hooks are a vast improvement upon it in point of finish. When, however, we consider that this improvement represents the evolution of some two thousands years it amounts to comparatively little.

These bronze hooks are of many types, from the true gorge, the bent gorge, the double simple hook, the double barbed hook to the true barbed hook as we now know it. As regards the hooks and gorges of our own time; we find, as we may expect to, in localities where man has, till recently, been in the Stone-age, fish-hooks of much more primitive type than the Bronze hooks of 2,000 years ago. For example, we have from the vast area of islands of the South Pacific, fish-hooks chiefly composed of the shells of Mollusca and Turtles, varied by the occasional use of bone and wood. From Arctic America we have a large variety of most primitive hooks, of bone, wood, walrus-ivory, &c., with the introduction, here and there, of stone and scraps of metal, in the shape of copper boat nails and fragments of hoop iron : in Alaska a gorge formed of a piece of bone pointed at either end is in ordinary use ; whilst in the Hudson Bay district, stone gorges were in actual use for fishing in the present century. These recent stone gorges seem to show considerable light upon the probable "*modus operandi*" of the many mysterious flint flakes, pointed at both ends, so abundant in our museums.

Interesting illustrations occur, not only in the South Pacific, but also in the Arctic area, of the sudden transition of man from the stone to the iron age.

Frequently the iron wire used by European travellers for binding wood cases, &c., is eagerly sought after by the natives and converted into fish-hooks, and it often happens that such wire is actually adapted to a shank of shell or bone. In the Arctic regions, the use of boat-nails, scrap iron, and even the metal of tins for preserved foods shows the keen appreciation of metal in localities where the precious material has hitherto been unknown.

The fish-gorge above referred to is somewhat similar to the needle used in the present day for catching eels : in fact, Allcocks, of Redditch, actually still make steel gorges. The earliest known gorges are undoubtedly of flint, and date back to the Neolithic Period. The more recent are of bone, used on the shores of Alaska.

They consist of a piece of suitable material sharpened at either end like a "tip-cat," and tied round the middle with the fishing line. When baited, the gorge is placed on the same plane as the line, and covered with the bait, whether it be a worm or a piece of seal or whale fat. When the fish swallows this, which it can easily do, a sharp jerk on the line by the fisherman, or even a movement to escape on the part of the fish, brings the gorge at right angles to the line, and the sharp-pointed ends enter the side of the gullet and naturally secure the fish.

Having thus briefly glanced at the primitive history of the Fish-hook, I think we may conclude that one of the most remarkable facts connected with this interesting appliance is, that whilst the Bronze-age deposits of the Swiss Lake Dwellings show the existence of a barbed metal hook differing only in point of finish from the steel hooks of our own time, we find hooks and gorges of infinitely more primitive type, and formed of far cruder materials, in common use right down to the present day.

Not only so, but even in England at this present moment, there exist in actual use fish-hooks, or to be more correct, gorges, of *wood* ; of a form so primitive that the bronze hooks, already referred to, are works of art compared to them.

Last year (1897) I heard by accident that fish hooks of wood were still in use on the Essex Coast. I at once put myself in communication with several friends in the county with a view to finding out what these hooks were, and where they were used. I am sorry to say that most of my enquiries were regarded as a supreme joke by my friends ; and I at length concluded that my information was not correct. Another friend, however, who had a yacht, told me he had seen long lines with hooks of thorns hung out on the fences to dry, and armed with this fact I visited a probable locality on the first opportunity.

Here my first enquiries, I regret to say, were regarded as an attempt to get what I believe is known as a " Rise " out of my man ; and his reply and those of others were not exactly polite. At length, I met a fisher-boy who seemed to know the the hooks quite well, and he directed me to a village some three miles away. I at once started off, and, arriving there, I made further enquiries, and was directed to a man, whom we will call " Tom," who was at that time engaged in tarring a boat. " He was about the only man now who used wooden hooks'

Another mile brought me to a fishing boat, hauled up on the shore and a man at work at her. " Are you Tom —— " I asked. He said he was, so I at once asked him if he used wooden hooks. He said he did, and that he had a long line down now, and if I would wait half-an-hour, the tide would be out far enough, and he was going to get the fish. With that he went on with his work and I cogitated over a pipe that, in half-an-hour, I was going to participate in a fishing expedition which, for primitive simplicity, was a distinct survival of that of Neolithic man of perhaps four thousand years ago. When the tide served, we visited the lines, and found a fair number of flounders on them which Tom took charge of, whilst I, for a consideration, took charge of the hooks and lines.

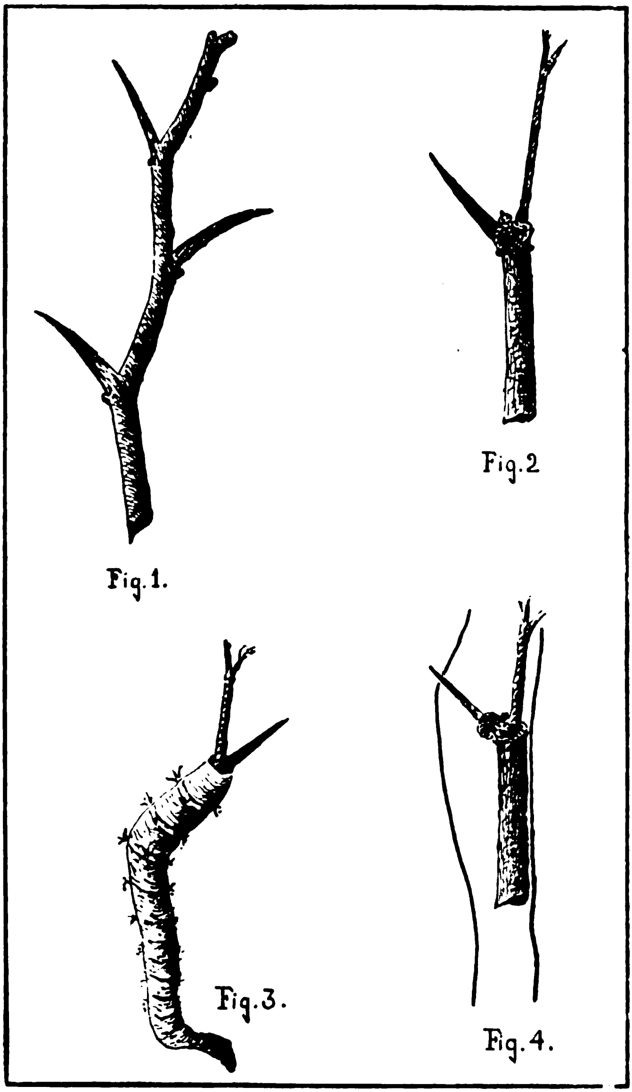
Fig. 1.
Fig. 2
Fig. 3.
Fig. 4.

FISH-HOOKS OR GORGES MADE OF THORNS, USED ON THE ESSEX COAST.

Fig. 1. Stem of White-thorn, showing the Thorns from which the Hooks are made, *in situ*.

Fig. 2. A hook or gorge, with the fishing line attached

Fig. 3. A hook, showing the method of baiting with a Lob-Worm (*Arenicola*.)

Fig. 4. A thorn hook, showing its position in the gullet of a captured fish, which has swallowed the gorge

These lines are of the ordinary kind used for laying down at low tide pegged at either end, and having the hooks attached to snoods at intervals, in the ordinary way. The hooks, or to be correct, gorges, are *thorns* of the Whitethorn (see Fig. 1) with about an inch of the stem, cut as shown in Fig. 2. The bark is trimmed off, and a bit of twine attached. The bait, an ordinary lob-worm, is attached or pushed over the gorge, as in Fig. 3; from which it will be readily seen that, whilst it is a very simple matter for a fish to swallow the bait and gorge : it is impossible for it to be ejected or in any way got rid of : for the apex of the thorn pointing at the angle it does, and being kept in its position by the piece of the line on the one hand and the pressure of the shank of the gorge on the other; must pierce the wall of the gullet of the fish, and hold it even more securely than any steel hook of the most scientific manufacture could do. See Fig. 4.

In order to get as much information as I could, I questioned Tom pretty severely. I need not quote the conversation *verbatim*, though it was rather amusing. I first asked him why he used thorn-hooks at all. He said nearly everyone did at one time; his father did and his grandfather did: (N.B. This is a grand reason, and I often get it in answer to questions as to old customs, &c.). I asked, then, if thorn-hooks held the fish as well as steel ones did. He did not seem to know, but thought they did, besides they were so much cheaper, as they cost nothing. Just then we had got to a white-thorn bush, and he cut a dozen or so hooks in a very few minutes, trimmed them up and gave them to me. "But," I said, "Why not use steel hooks, they would surely last longer?" "Well," he said, "You see those steel hooks get sanded, and the wooden ones don't." Now here was a *real* reason; so, upon further investigation, I found that as these long lines were laid on the bottom at low tide: when the flow took place, the fine mud and sand had a tendency to silt over, and conceal a baited *steel* hook; whereas the *thorn* hook possessed a buoyancy that kept it from being thus covered up, and hidden from the flounders coming up and feeding with the tide.

I also learnt that in byegone days, when thorn-hooks were in more general use, they were baited by the women of the village, and that they were paid a half-penny per hundred hooks for the work.

A friend of mine who has travelled on the Amazon, informs me that the natives living on the shores of that river catch fish by means of a hook formed of the thorn of a species of *Acacia.*

I have further ascertained that near Bordeaux two kinds of wooden gorges are used for fishing. One is in the form of a spindle, like our eel gorges, and is known as "*hain* :" the other is exactly similar to our Essex example, and is made of the same wood : this is called "*Clabéon.*"

It is still more interesting to know that some of the natives of the Malay Peninsula still use a hook of a wooden thorn practically the same as that used by the Essex fishermen of to day.

NOTES ON SOME RELICS OF EARLY MAN IN THE NEIGHBOURHOOD OF CHELMSFORD.

By HENRY MOTHERSOLE.

NEITHER Chelmsford nor its immediate neighbourhood has, so far as I am aware, been hitherto noted for many traces of early man, and perhaps therefore, a few remarks recording some implements and worked flints which I have collected in the district may be of interest.

Of the Palæolithic period only a few relics have been found. My whole collection comprises but some half-a-dozen "flakes" and two implements. The best finished one is unworked at the butt-end, and measures 3½" × 3"; this I found in a cart-way at Pryors Farm, Broomfield, where I had previously found two worked flints of apparently the same age.

Judging by the number of "worked" flints, "flakes," "cores" and burnt stones found, I assume that the Chelmsford district was fairly well populated in Neolithic times. In the surface-soil, and in the upper part of the Brick-earth in the Valley of the Cann, to a depth of about three feet, a great number of flakes have been detected, and with them I have been fortunate enough to find two leaf-shaped arrow-heads. One of these, of grey flint, is a very beautiful example. A number of "cores," "pot-boilers" and "scrapers" occurred; many of these were found in undisturbed Brick-earth. I also picked up from the surface a flake arrow-head, and a small flint flake, similar to those figured by Sir John Lubbock (*Prehistoric Times*, p. 89) but my flake is very neatly notched on either side of the smaller end. I submitted this specimen to Mr. Worthington Smith, F.L.S., and he writes that the notches were probably caused by the flake having been used to scrape some small object, such as a bone needle.

From Writtle I have obtained a triangular shaped flint, ground on both sides.

At Broomfield I found about a dozen of well-fashioned "scrapers," two of them being of rather uncommon form.

Great Baddow and Ongar have each furnished me with a fragment of a polished flint axe being the cutting edges, polished.

I have also a perforated Hammer or Mace-head, made from an oval pebble of quartzite (?) 5" long, 4½ wide and 1½" thick. The hole was evidently drilled from both sides, being 1" in diameter at the centre and 1½" at the surface. This specimen I secured from a private museum, the exhibition space being the back wall of a cottage. The other specimens consisted of an old flint lock of a pistol, ornaments in baked clay, cowrie shells and other *bric-à-brac* of a similar character, the whole being plentifully bedecked with red paint; fortunately the hammer stone escaped with only one spot.

Of Bronze implements I have two celts of the ordinary type, one 4" long, the other 3½"; also a fragment of a larger one. These I obtained from a Marine Store in the town, and they are probably local in origin. This may serve as a hint to others living in towns to keep an eye upon similar repositories of miscellaneous odds and ends.

In conclusion, I hope that my measure of success in a neglected and unpromising locality may stimulate other members to examine closely all stone-heaps, ploughed fields and other places where stones are to be found, and by so doing add a little to our knowledge of the distribution of the early inhabitants of our County.

TWO INTERESTING PRIMULA PLANTS.

By MILLER CHRISTY, F.L.S.

(I.) AN UNUSUAL PHYLLODIC ABERRATION OF THE PRIMROSE.

ABOUT the middle of February 1898, our Vice-President, Mr. E. A. Fitch, F.L.S., of Brick House, Maldon, discovered in Hazeleigh Hall Wood, a plant of the Common Primrose (*Primula acaulis*), which bears very remarkable phyllodic flowers, though normal in all other respects.

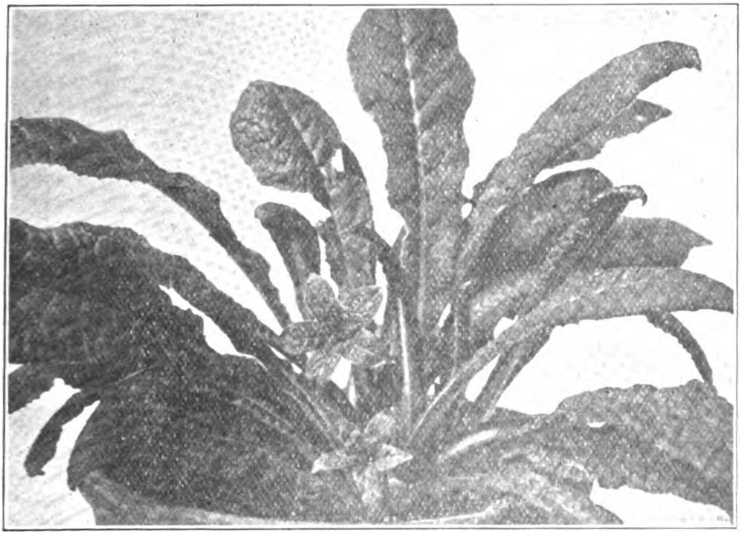

Fig. 1 Uncommon phyllodic aberration of the Primrose
Hazeleigh Hall Wood, Essex.

Phyllodic flowers are produced not uncommonly in many species of plants, especially in those belonging to the genus *Primula*. Everyone is familiar with the common cultivated phyllodic variety of the Primrose and Polyanthus, in which each sepal is developed into a miniature green leaf, sometimes as much as, or more than, an inch in length. These leaves surround, and often project beyond, the corolla. Phyllody of the calyx is also found occasionally in the flowers of the Primrose and the "True," or "Bardfield," Oxlip (*P. elatior*) when growing in a wild state. When phyllody occurs in connection with the flowers of any form of *Primula* borne in umbels (as in the case of the cultivated Polyanthus or the Wild Oxlip), the bracts at the base of each pedicel springing from the top of the peduncle are also generally developed into leaves, which are sometimes of considerable size.

Although I have for many years made a special study of the British members of the genus *Primula*, I have never yet seen a specimen, either wild or cultivated, bearing phyllodic flowers quite like those borne by Mr. Fitch's plant. In this case (as shown in the accompanying illustration, Fig. 1), all the inner floral organs (except the pistil of one of the two flowers shown) have entirely aborted, forming a small knob not much larger than a pin's head at the bottom of the tube of the calyx. The flowers consist, therefore, of nothing but an abnormal foliated calyx. The method of foliation differs, however, from that usually met with, as described above. Instead of having, in place of ordinary sepals, elongated wrinkled green leaves, very much like the ordinary leaves of the plant, but smaller, and often more or less curled laterally, this specimen has the calyx-leaves of ovate-acute shape, flat, and uncurled, but little wrinkled, and joined together to form a calyx of a star-like form, looking (except so far as colour is concerned) much like the corolla of some new flower. The origin of these leaves, from the enlargement of the calyx-teeth, is, in short, much more obvious than in the case of the commoner phyllodic variety of the Primrose.

When found, the plant bore five or six flowers of the kind above described, though only two are shown in the accompanying illustration. Some other flowers which promised to develop did not do so, probably because the plant was raised and potted. At the date of writing (July 15th), the two "flowers" shown are still on the plant, having undergone no change since the plant was found early in February last. They seem, indeed, unlike ordinary flowers, as permanent as the leaves they so closely resemble in all but shape. As I have it now under cultivation, I shall be able to observe and record future developments.

It may very well be that plants bearing "flowers" of this nature are commoner than is supposed to be the case; for, as the blossoms exactly resemble the leaves in colour, they are very easily overlooked. Still, as I have stated, I have never before met with a plant bearing similar flowers.

(II.) ON PRIMULA ELATIOR × VERIS.

Fifteen years ago, I recorded[1] in the publications of this Society the occurrence in Britain (for the first time, so far as known) of hybrid plants between the "True" Oxlip (*Primula elatior*) and the Common Cowslip (*P. veris*). Kerner had previously called attention[2] to the occurrence of this hybrid on the Continent. The two species occasionally grow there in close proximity; but, in spite of this fact, the hybrid in question occurs there so extremely rarely that Kerner was led to remark on it. The same observation certainly holds good for England. When I published my original record, I was only able to cite two occasions on which I had met with examples of this hybrid—in Madghob's Wood, Saffron Walden, on April 23rd, 1883, and on a

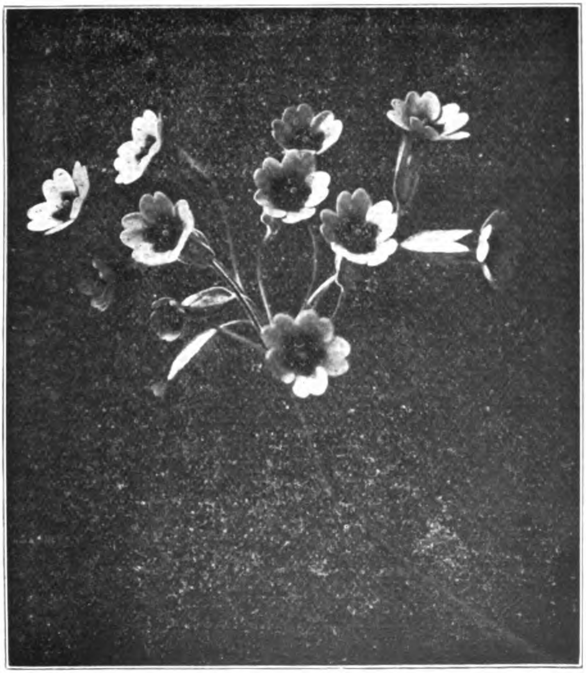

Fig. 2. Hybrid between *Primula elatior* and *P. veris*.
Horningsheath, Suffolk.

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[1] *Transactions of the Essex Field Club*, iii. (1884), pp. 253-256.

[2] *Oester. Bot. Zeit.*, xxv. (1875), p. 86.

hedge-bank at Wethersfield, Essex, on May 1st following. Since that time, I have only twice seen other examples of the hybrid—in Long Wood, Horningsheath, Suffolk, on April 25th, 1897, and in Balsham Wood, Cambs., on May 15th, 1898. I have elsewhere[3] discussed the probable causes of the extreme rarity of this hybrid, which is the more remarkable in view of the extreme facility with which (as I have shown) hybrids arise between the Oxlip and the Primrose, and between the Primrose and the Cowslip. Owing to the unusual occurence of this hybrid, it has been thought well to give here a photographic figure of it. The accompanying illustration (Fig. 2) shows a flower of one of the plants I obtained at Horningsheath in April last year, and still have under cultivation. Unfortunately, through having been kept under glass, the flower has acquired a habit slightly different from that it had when growing wild, having become somewhat paler in colour and more straggling; but the illustration given represents, nevertheless, sufficiently well the appearance of the flower in question.

AN IMPLEMENT MADE FROM A STAG'S ANTLER, FROM WORMINGFORD, ESSEX.

BY WORTHINGTON G. SMITH, F.L.S., M.A.I.

[Read July 2nd, 1898.]

THE accompanying illustration shows, one-third the actual size, an implement made from the shaft of an antler of Red Deer and kindly presented to the Museum of the Essex Field Club by Mr. Percy Gearing, of the "Wake Arms" Inn, Epping Forest.[1]

The implement was found whilst putting in the foundations of the new bridge which crosses the river Stour, and which connects the boundaries of Essex and West Suffolk. The situation is near the old ford in the village of Wormingford. The implement, according to the statement of the foreman, was found in a bed of Alluvium, 10 feet from the surface and below the foundations of a former timber structure or pile bridge, about eighty years old.

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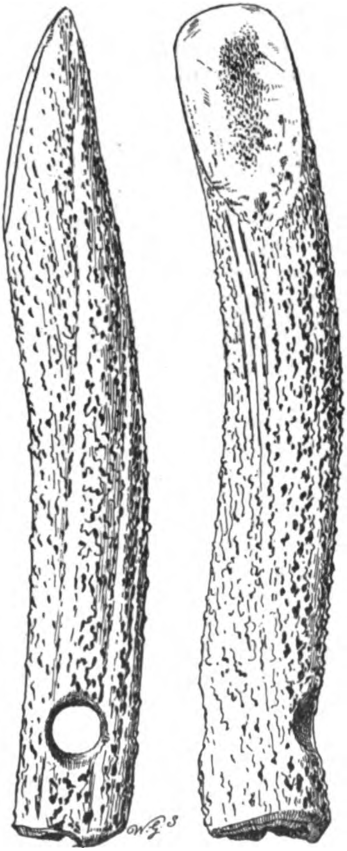
[3] *Journ. Linn. Soc.* (*Bot.*), xxxiii. (1897), p. 198.

[1] The Club is indebted to Mr. Smith's accustomed kindness for both the drawing and process block of this illustration.—Ed.]

The antler, as will be seen from the illustration, has a hole at the base for suspension—not for hafting—this hole has not been drilled with a drilling tool but cut out and scraped round as if with some imperfect instrument. The upper chisel-shaped end has been cut and rubbed to shape; it is lustrous black in colour and very finely and *irregularly* striate. At the back of the chisel-surface at the right hand of the left hand figure, to 1¾in. down from the top, the surface is *transversely*, regularly and finely striate as if from contact with some gritty quickly revolving material. Its weight is 1lb. 7oz.



IMPLEMENT OF STAG'S ANTLER, FROM WORMINGFORD.

[*One-third natural size.*]

I do not remember having seen any implement quite like this, or to have read of one that exactly accords; but my impression is that the instrument has been used by a potter with a wheel and that the chisel-surface has become lustrous and irregularly striate by its use in manipulating clay for pots and that the fine regular transverse striations at the back have been made in shaping the slightly gritty quickly revolving pot. The tool could not have been used as a lever or chisel, had it been so used the striæ would have been longitudinal and not transverse. Its rudeness may indicate Romano-British times.

If any readers of the ESSEX NATURALIST know of a tool similar with this in any museum or private collection it would be well if they would kindly communicate with the Editor.

[We also submitted this implement to Mr. Charles H. Read, M.A., F.S.A., Keeper of the British and Mediæval Antiquities and Ethnography, British Museum, and he kindly replied as follows:—"In the first place I scarcely think it was ever hafted, the hole is rather small for so long a blade, and to my eyes there is no indication of the kind of wear produced by a haft. The hole, therefore, would only be used as a means of suspension. As to its use, there are many ways in which such an implement could be used; but the only purpose that I can at this moment think of which meets all the difficulties—such as the transverse striations, &c.—is that it was used for barking trees. The implement having been introduced into a cut in the bark, would then be run downwards, thus producing the faint lines across the edge. From the curve of the *other* side of the edge, this face would not be so exposed to wear." It will be noted that Mr. Worthington Smith does not agree with this suggested use of the implement, and in face of the divergent views of eminent authorities, we can only await further information to be derived from comparison with similar implements, if such already exist in collections, or the discovery of other examples under circumstances that would afford a clue to their history and use. The implement, at Mr. Gearing's desire, will be placed in the Club's Essex County Museum at Stratford.—ED.]

THE ENTOMOSTRACA OF EPPING FOREST, WITH SOME GENERAL REMARKS ON THE GROUP.

(*Continued from page* 274.)

By D. J. SCOURFIELD.

[*Read November 27th, 1897.*]

PART III.

A DETAILED LIST OF THE EPPING FOREST SPECIES.[1]

THE following list of the Entomostraca found in Epping Forest contains references to the principal synonyms under which some of the forms have been previously alluded to by authors in this country, and also references to the British publications in which figures and descriptions of the species recorded may be found. A number of miscellaneous notes in connection with the individual species have likewise been added, but nothing has been said about their comparative abundance or seasonal distribution, as all the available data on these subjects have already been given. With regard to the rarer species, the stations from which they have been taken have also been mentioned, if these are not already fully apparent from the first Table in Part II.

PHYLLOPODA.

[**Chirocephalus diaphanus,** Prevost. According to Baird (2),[2] p. 54, this species was found near Epping by Mr. Doubleday. It does not appear to have been since recorded, and can scarcely be included in the list of Epping Forest Entomostraca, but I have thought it advisable to call attention to the fact that it has been found in the district, although so long ago.]

CLADOCERA.

Family—SIDIDÆ.

Sida crystallina, O. F. Müller.—Baird (2), Bolton (6). This beautiful species has only been taken in the "Shoulder of Mutton Pond" and the adjoining pool in Wanstead Park.

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[1] Part I., "Some General Remarks on Entomostraca" was printed *ante* pp. 193-210; and Part II., "Chief Results of Work on the Entomostraca of Epping Forest," at pp. 259-274 *ante*.—[ED.]

[2] The figures in brackets "( )" refer to the numbers of the papers in the Bibliography appended (See Part IV., pp. 328-334).

Diaphanosoma brandtianum, Fischer. — *Daphnella wingii* (in part), Baird (2); *Daphnella brachyurum*, Scourfield (82 and 85). It is held by Richard in his recent *Revision* (101) that the two forms *D. brachyurum* (Liévin) and *D. brandtianum* (Fischer) are distinct species, although sometimes very difficult to distinguish. The Epping Forest forms evidently belong to the last-named species.

Family—DAPHNIDÆ.

Moina rectirostris, O. F. Müller.—Baird (2), Brady (20). The single gathering of this species was from the margin of the Warren Pond, Chingford, and consisted of ordinary and ephippial females and males. The ephippial females were smaller than the ordinary forms (which were about $\frac{1}{19}''$) and noticeably reddish. The ephippium contained only one egg—an important fact from a diagnostic point of view, as the closely related *M. brachiata* is stated to have two eggs in the ephippium. The males were still smaller than the ephippial females, and the tip of each of their antennules was furnished with the usual nine olfactory setæ and five hooks bifurcated at the extremity.

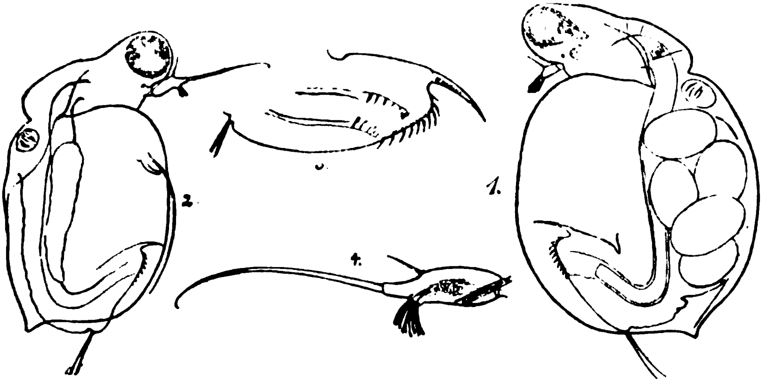
Ceriodaphnia megalops, Sars.—*Daphnia reticulata* (in part), Baird (2), Tab. VII., Fig. 5; *Ceriodaphnia megops*, Scourfield (81 and 82).

Ceriodaphnia rotunda, Strauss. — *Daphnia rotunda*, Baird (2).

Ceriodaphnia reticulata, Jurine. — *Daphnia reticulata*, Baird (2). From Higham Park a small variety of this species has been seen which may have been *C. kurzii*, Stingelin (104).

Ceriodaphnia quadrangula, O. F. Müller.—Scourfield (81 and 82). I have retained the name *quadrangula* for this species, although our forms are probably not the same as those recorded by Sars under that name. They are, on the contrary, more closely allied to that author's *C. pulchella*.

Ceriodaphnia scitula, Herrick (95).—This species, which has only been found at Higham Park, is an addition to the British fauna. A few words of description, based on our Epping Forest examples, may not be out of place, therefore, in this connection. The species is rather a large one—well-developed females reaching at least $\frac{1}{30}''$ in length. The general outlines of the shell, &c., may be readily seen from the accompanying drawings, so that no detailed remarks on these are necessary. The shell is covered with a nearly regular network of comparatively small hexagons, which, although perfectly well defined, do not appear to be so strongly developed as in the specimens described by Herrick. The fornices are prominent, but not angulated, though in the males there may be an indication of a tooth at the point of greatest extension. The antennules in the female are small, but those of the male are large, being, in fact, probably larger than in any other known species, with the exception of *C. megalops*. The post-abdomen is tapered towards the end, and is furnished with about 10 anal teeth. The terminal claws are without combs. The females carry about eight eggs in the brood chamber, and these are retained in position by a very large spur, which quite overshadows the little projection occupying the place of the second spur.



Ceriodaphnia scitula, Herrick.
1. Female × 50. 2. Male × 50.
3. Post-abdomen of female × 85.
4. Antennule of male × 140.

Scapholeberis mucronata, O. F. Müller.—*Daphnia mucronata*, Baird (2); *S. mucronata*, Scourfield (82 and 83). The evidence from the whole of Epping Forest is the same as that already recorded from Wanstead Park, namely—that during the earlier part of the annual period of activity only the *cornuta* form is to be found, the typical form not making its appearance until August at the earliest.

Simocephalus vetulus, O. F. Müller.—*Daphnia vetula*, Baird (2).

Simocephalus exspinosus, De Geer.—*Daphnia vetula* (in part probably), Baird (2). This form is distinguished by such small characters from the preceding that it was not separately recorded during the earlier part of the work on the Epping Forest Entomostraca. It appears to be a common species in the Epping Forest district.

Daphnia magna, Strauss.—*D. schaefferi*, Baird (2); *D. magna*, Brady (20). This, the largest species of the genus, seems to be almost solely an inhabitant of little duck-ponds. The six Epping Forest stations have been, three duck-ponds at Sewardstone, one on Theydon Bois Green, Woodridden Farm Pond, and a little roadside pond near Queen Elizabeth's Lodge, Chingford. The "ephippia" have also been seen in the "Green Man" pond, Leytonstone.

Daphnia pulex, De Geer.– Baird (2). Brady (20).

Daphnia obtusa, Kurz.—Creighton (26). Brady (20).

Daphnia lacustris, Sars.—Brady (20); *D. longispina* (in part), Scourfield (82). Prof. Brady (20) considers this to be distinct from the following species. As both forms occur in the Epping Forest district, I have entered them as independent species in this list, although the records for the two have not been kept separate.

Daphnia longispina, O. F. Müller.—*D. pulex* var. *longispina*, Baird (2); *D. longispina*, Brady (20), Scourfield (82).

Daphnia hyalina, Leydig.—Scourfield (81), Brady (20).

Daphnia ? galeata, Sars.—*D. galeata*, Scourfield (81 and 82). By comparison with specimens of *D. galeata* kindly sent to me by Prof. Sars, I have been able to see that our Epping Forest form is not only not a typical representative of the species, but that it may even be quite distinct. As I cannot decide, however, to which of the other hyaline species it belongs, I have preferred to continue to refer it doubtfully to *D. galeata*. The typical *D. galeata* has been recorded as British by Prof. Brady (20).

Daphnia ? cucullata, Sars. –? *D. kahlbergensis*, Brady (20). This form, which I have recorded in the paper on the Entomostraca of Wanstead Park (82) as *D. cucullata*, is almost exactly similar to the foregoing species, but is without the eye-spot. It is certainly not a characteristic representative of *D. cucullata*, but, on the other hand, it cannot with greater certainty be referred to any other species.

Family—BOSMINIDÆ.

Bosmina longirostris, O. F. Müller.—? Baird (2), Norman and Brady (56).

Bosmina cornuta, Jurine. — This has only been previously noted as British in the lists of species published in the Journal of the Quekett Micro. Club (57). It is very closely related to *D. longirostris*, but in its typical form the antennules are rather short, recurved and divergent, while the two shell-spines are reduced to mere knobs. Stingelin (104) has remarked, however, that this species is subject to great seasonal variation.

Family—LYNCODAPHNIDÆ.

Macrothrix laticornis, Jurine.—Baird (2), Norman and Brady (56).

Macrothrix hirsuticornis, Norman and Brady (56). Without doubt this is one of the best records in the whole list of Epping Forest Entomostraca. Since the species was first described in 1867, it appears to have been only once again recorded in the British Isles (79, Part II.), and on the Continent it has only been found by a few observers. It is a fine species, being in fact the largest of the genus. Numerous specimens were taken in Connaught Water on the 10th March, 1894, but curiously enough none could be found about a month later, nor has the species been seen again.

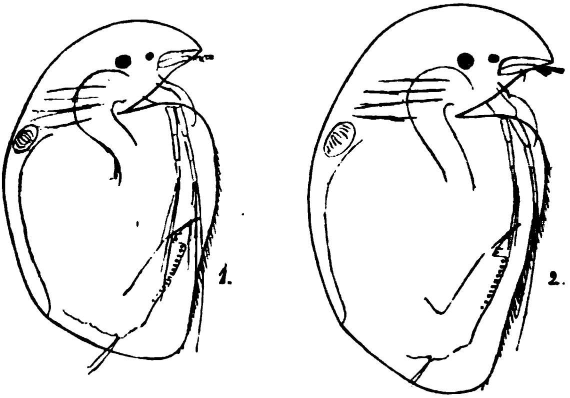
Ilyocryptus sordidus, Liévin.—*Acantholeberis sordidus*, Norman (55); *I. sordidus*, Norman and Brady (56), Bolton (6).

Family—LYNCEIDÆ.

Eurycercus lamellatus, O. F. Müller.—Baird (2), Norman and Brady (56).

Acroperus harpæ, Baird.—Baird (2); *Lynceus harpæ*, Norman and Brady (56). Figures of the typical form of this species and of the variety already referred to in Part II. are given in the accompanying illustration. From these it will be seen that the variety differs mainly from the type by its larger size and the very much greater development of the head. It seems to me very probable that this variety is the same as the form described by Koch (96) as *Lynceus leucocephalus*, but Prof. Sars informs me that it is certainly not the form described by himself under that name. I may mention that I have also seen specimens of the variety here referred to from Shetland (through the kindness of Mr. T. Scott), from Fleet in Hampshire, and from the Lake District.

Camptocercus rectirostris, Schödler.—*C. macrurus* (probably), Baird (2), Norman and Brady (56), Scourfield (82 and 85). This seems to be the usual British form, and as it differs considerably from that known to continental workers as typical *C. macrurus*, it seems advisable to employ Schödler's name for it.



Acroperus harpæ, Baird, and Variety.
1. *Acroperus harpæ* (typical) × 60.
2. ,, ,, (variety) × 60.

Leydigia quadrangularis, Leydig.—*Lynceus acanthocercoides* (probably), Norman and Brady (56); *Leydigia acanthocercoides*, Scourfield (82 and 85). My friend, Mr. T. Scott, informs me that he has had specimens of the true *L. acanthocercoides* from Prof. Sars, and that they differ from the common British form, which must therefore be called *L. quadrangularis*.

Graptoleberis testudinaria, Fischer.—*Lynceus testudinarius*, Norman and Brady (56).

Alona guttata, Sars.—*Lynceus guttatus*, Norman and Brady (56).

Alona tenuicaudis, Sars.—*Lynceus tenuicaudis*, Norman and Brady (56).

Alona quadrangularis, O. F. Müller.—Baird (2); *Lynceus quadrangularis*, Norman and Brady (56); *A. costata*, Scott (79, Part I.)

Alona affinis, Leydig.—Hodgson (43), Scourfield (85); *A. quadrangularis*, Scott (79, Part I.)

Alona costata, Sars.—*Lynceus costatus*, Norman and Brady (56).

Alona rectangula, Sars.—*Alona intermedia*, Scourfield (81, 82 and 85). Prof. Sars informs me that the little *Alona* recorded as *A. intermedia* (81) is not the same as that so named by him, but that it is unquestionably the species described as *A. rectangula*. It also seems to be the same as the *A. pulchra* of Matile's paper, "Cladoceren der Umgegend von Moskau" (*Bull. Soc. Imp. Nat. Moscow*, Vol. IV., 1890).

Alona rustica, T. Scott (79, Part I.)—As already mentioned in Part I., this species was only obtained by washing pieces of wet moss. These were taken from a bog by the side of Lodge Road leading to Copped Hall.

Alonella excisa, Fischer.—*Lynceus exiguus* (in part probably), Norman and Brady (56). Besides the two localities given in Table I., this little species has also been taken in a tiny pond close to the "Wake Arms."

Alonella nana, Baird.—*Acroperus nanus*, Baird (2); *Lynceus nanus*, Norman and Brady (56).

Alonella rostrata, Koch.—*Lynceus rostratus*, Norman and Brady (56).

Pleuroxus trigonellus, O. F. Müller.—Baird (2); *Lynceus trigonellus*, Norman and Brady (56).

Pleuroxus uncinatus, Baird.—Baird (2); *Lynceus uncinatus*, Norman and Brady (56).

Peracantha truncata, O. F. Müller.—Baird (2); *Lynceus truncatus*, Norman and Brady (56).

Chydorus sphæricus, O. F. Müller.—Baird (2); *Lynceus sphæricus*, Norman and Brady (56).

Chydorus cœlatus, Schödler.—*Lynceus sphæricus* var. *favosa*, Brady (11); *C. cœlatus*, Scourfield (85). Only noticed from the pond just south of the Wake Valley Pond.

Chydorus latus, Sars.—*C. ovalis*, Scourfield (81); *C. latus*, Scourfield (85). In addition to Eagle Pond and Leyton Flats, this species has been taken in a pool in the piece of Forest lying between Oak Hill and the East London Waterworks, Walthamstow.

Chydorus globosus, Baird.—Baird (2); *Lynceus globosus*, Norman and Brady (56).

Monospilus tenuirostris, Fischer.—Norman and Brady (56), T. Scott (64, Part II.) The presence of this very peculiar species in the Forest district was first ascertained by its being found in the stomach of a roach from the Eagle Pond. It has since been taken with the net from the same piece of water.

BRANCHIURA.

Argulus foliaceus, Linn.—Baird (2), Bolton (6).

OSTRACODA.[3]

Family—CYPRIDIDÆ.

Cypria exsculpta, Fischer.—*Cypris striolata*, Brady (10); *Cypria exsculpta*, Brady and Norman (21).

Cypria ophthalmica, Jurine.—*Cypris compressa*, Baird (2), Brady (10).

Cyclocypris serena, Koch.—*Cypris lævis*, Brady (10); *Cypris serena*, Brady and Norman (21, Part I.), Scourfield (82).

Cyclocypris lævis, O. F. Müller.—*Cypris minuta*, Baird (2); *Cypris ovum*, Brady (10); *Cypria lævis*, Brady and Norman (21, Part I.)

Cypris fuscata, Jurine. — *Cypris fusca*, Baird (2), Brady (10).

Cypris incongruens, Ramdohr.—Brady (10). The two records of this species were from duck-ponds at Chingford Hatch and Sewardstone.

Cypris virens, Jurine.—*C. tristriata*, Baird (2); *C. virens*, Brady (10). This large species is essentially an inhabitant of very small pieces of water, especially such as are well stocked with aquatic vegetation.

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[3] Brady and Norman's Monograph of the Ostracoda (21), as amended by the Appendix to the second part, has been followed in the naming of these animals.

Cypris ? reticulata, Zaddach.—*C. tessellata* (in part), Brady (10). Only the immature "tessellata" forms from Wanstead Park have hitherto been seen, so that it is still a little uncertain whether they should be referred to *C. reticulata* or not.

Cypris obliqua, Brady (10). In the account of the Wanstead Park Entomostraca (82) this species was unfortunately included with *C. fuscata*.

Herpetocypris reptans, Baird.—*Candona reptans*, Baird (2); *Cypris reptans*, Brady (10); *Erpetocypris reptans*, Brady and Norman (21, Part I.), Scourfield (82).

Herpetocypris strigata, O. F. Müller.—*Cypris ornata*, Brady (14); *Erpetocypris strigata*, Brady and Norman (21, Part I.) The localities in which this species has been found are:—Ponds in the fields between High Beach and Waltham, ditch leading into Connaught Water, pond at Fairmead, duck-pond near the "Volunteer," and Gilbert's Slade, Snaresbrook.

Herpetocypris tumefacta, Brady and Robertson.—*Cypris tumefacta*, B. and R. (21a); *Erpetocypris tumefacta*, B. and N. (21). The sole locality for this interesting species is a little brook near the entrance to Gilbert's Slade, Snaresbrook.

Prionocypris serrata, Norman,—*Candona serratc*, Norman (54); *Cypris serrata*, Brady (10); *Erpetocypris serrata*, Brady and Norman (21, Part I.) This species has been obtained from one of the reservoirs of the East London Waterworks at Tottenham. It does not appear in Table I. nor in the statement of the relative abundance of the species, as it was only found on the occasion of the Club's visit to the Waterworks on 2nd July, 1898.

Cypridopsis villosa, Jurine.—*Cypris Westwoodii*, Baird (2); *Cypridopsis villosa*, Brady (10). Two little duck-ponds at Sewardstone are the only stations where this has been found.

Pionocypris vidua, O. F. Müller.—*Cypris vidua* and *C. sella*, Baird (2); *Cypridopsis vidua*, Brady (10), B. and N. (21, Part I.), Scourfield (82).

Notodromas monacha, O. F. Müller.—*Cypris monacha*, Baird (2); *Notodromas monachus*, Brady (10); *N. monacha*, Scourfield (83). Occurs only at Wanstead Park so far as yet known.

Ilyocypris gibba, Ramdohr.—*Cypris gibba* (in part), Brady (10). In one of the Golding's Hill Ponds a form has been seen which made some approach to *I. biplicata* Koch (= *I. bradii* Sars), but it could not be certainly identified as that species.

Candona candida, O. F. Müller.—*C. lucens*, Baird (2); *C. candida*, Brady (10).

Candona lactea, Baird.—Baird (2a), Brady (10). Besides the two localities mentioned in Table I., this species has also been taken in a pond near High Beach village.

Candona compressa, Koch.—*C. compressa* and *C. albicans*, Brady (10); *C. pubescens*, Brady and Norman (21, Part I). Like *Herpetocypris tumefacta* this has only been obtained from the little brook near the entrance to Gilbert's Slade.

Candona pubescens, Koch.—*C. abbreviata* (Brady M.S.), Scourfield (82); *C. pubescens*, Brady and Norman (21, Part II.) This species, which was at first thought by Prof. G. S. Brady to be new to science, has since been identified with one of Koch's forms. Within the Epping Forest area it has only been found at Wanstead Park and this is in fact its only known British locality, as the reference to Pavenham in Brady and Norman's "Monograph" (21, Part II.), p. 729, was made under a misunderstanding.

Candona fabæformis, Fischer.—*C. diaphana*, Brady and Robertson (21a); *C fabæformis*, Brady and Norman (21). The specimens from Higham Park have been of the ordinary form, but those from the other localities have differed somewhat from the type although agreeing among themselves.

Family—CYTHERIDÆ.

Limnicythere inopinata, Baird.—*Cythere inopinata*, Baird (2); *L. inopinata*, Brady (10). Found in the "Green Man" pond, Leytonstone, as well as the two stations given in Table I.

COPEPODA.[4]

Family—CENTROPAGIDÆ.

Diaptomus castor, Jurine.—Baird (2), Lubbock (48), Brady, in part, (16), Brady (19). This large species is practically confined to small weedy pools, such as occur plentifully on Leyton Flats.

Diaptomus gracilis, Sars.—*D. westwoodii*, Lubbock (48); *D. gracilis*, Brady (19). The absence of this very common species from Connaught Water is perhaps the most remarkable fact about its distribution in the Epping Forest area.

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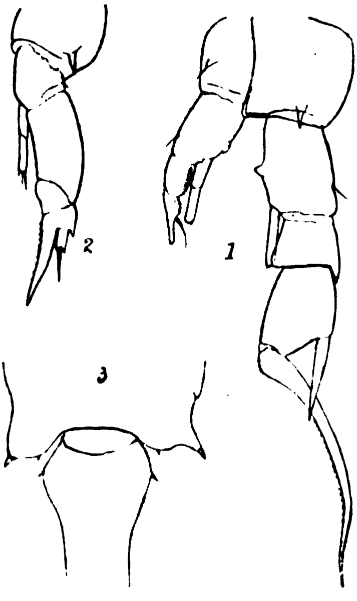
[4] The nomenclature adopted by Schmeil (103) has been followed as closely as possible for these animals.

Diaptomus vulgaris, Schmeil.—*D. cæruleus*, Schmeil (103, Part III.), 1896. In a "Nachtrag" to "Deutschlands freilebende Süsswasser Copepoden" Schmeil says that the name *cæruleus* must be abandoned in compliance with the rules issued for the guidance of contributors to the great zoological work now appearing, "Das Tierreich." He therefore proposes the name *vulgaris*, as the species is one of the commonest of the genus on the Continent, or at any rate in Germany.



Diaptomus vulgaris, Schmeil. (= *D. cæruleus*, Fischer).
1. Fifth feet of male × 120.
2. One of the fifth feet of female × 120.
3. End of thorax and first segment of abdomen of female × 80.

(After Schmeil).

This species, which has not hitherto been recorded as British, has been found so far only in "The Lake," Wanstead Park. It is probably much more common in this country, however, than might be supposed from this circumstance, as it is more than likely that this form has been mistaken for *D. gracilis*, to which it is very closely allied. The accompanying drawings will, it is believed, enable anyone to separate this from the foregoing.

Eurytemora lacinulata, Fischer —*Temora velox* (in part), Brady (16) ; *E. clausii*, Brady (19). The usual habitat of this species is in brackish pools near the coast. As a fresh water animal it is decidedly rare. In addition to the locality (Higham Park) given in Table I., this form has quite recently been found in one of the reservoirs of the East London Waterworks at Tottenham. I have also taken it in the "Long Pond," Hampton Court, and Mr. T. Scott records it from Castlemilk (69) and Possil Marsh (64, Part V.) These are the only British fresh-water localities for the species known to me.

Family—Cyclopidæ.

Cyclops strenuus, Fischer.—*C. clausii* and *C. brevicaudatus*, Lubbock (48) ; *C. strenuus* and *C. pulchellus*, Brady (16) ; *C. strenuus*, *C. vicinus*, and *C. abyssorum*, Brady (19) ; *C. vicinus*, Scourfield (82). The records for the type and the *vicinus* form have been given separately in Table I. The former is most frequently an inhabitant of small ponds, whereas the latter prefers the larger pieces of water.

Cyclops leuckarti, Claus. — *C. scourfieldi*, Brady (19) Scourfield (82) ; *C. leuckarti*, T. Scott (64, Part VII.)

Cyclops oithonoides, Sars.—*C. scourfieldi* var., Brady (19), Scourfield (82). In the "Nachtrag" (103) Schmeil says that specimens of *C. scourfieldi* var. sent to him by Prof. Brady proved to be *C. oithonoides* var. *hyalina*.

Cyclops dybowskii, Lande.—With the exception of its inclusion in a list of species found at one of the Quekett Club excursions in 1896 (57) this species has not been previously recorded in the British Isles.

Cyclops bicuspidatus, Claus.—*C. Thomasi*, Brady (19), *C. bicuspidatus* (in part), Scourfield (82).

Cyclops languidus, Sars.—Scourfield (85).

Cyclops vernalis, Fischer.—? *C. elongatus*, Brady (19) ; *C. bicuspidatus* (in part), Scourfield (82).

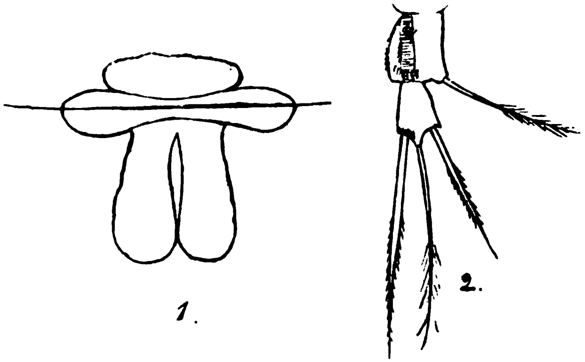
Cyclops bisetosus, Rehberg.—*C. bicuspidatus*, Brady (19) ; *C. bisetosus*, Scourfield (85).

Cyclops viridis, Jurine.—*C. brevicornis*, Lubbock (48) ; *C. gigas*, Brady (16) ; *C. viridis*, Brady (19). The "gigas" form, which is evidently the typical *C. viridis*, does not seem to be connected, in the Epping Forest District, with the "brevicornis" form by any intermediate links, and I have often been tempted to consider them specifically distinct in spite of the opposite opinion of Schmeil and other excellent observers. The former is an exceedingly widely distributed form, but rarely occurs in the open waters of ponds of moderate size, whilst the latter, on the contrary, is practically only found in such situations. I have noticed that in addition to its very much greater size, "*gigas*" can always be distinguished from "*brevicornis*" by the presence of a line of hairs on the inner margin of each caudal ramus, and by its longer ovisacs.

Cyclops bicolor, Sars. — *C. diaphanus*, Scourfield in J.Q.M.C. (57), V. p. 407 ; *C. bicolor*, Scourfield (85).

Cyclops fuscus, Jurine.—*C. coronatus*, Lubbock (48) ; *C. signatus*, Brady (16) and in part (19), Scourfield (82).

Cyclops albidus, Jurine. - *C. tenuicornis*, Lubbock (48), Brady (16), Scourfield (82) ; *C. signatus* (in part), Brady (19).



Cyclops bistriatus, Koch.
1. Receptaculum seminis × 150.
2. Fifth foot × 200.

Cyclops bistriatus, Koch.—*C. albidus* var. *distinctus*, Richard (fide Schmeil 103) ; *C. distinctus*, Schmeil (103) "Nachtrag." On three occasions I have taken specimens of a *Cyclops* curiously intermediate between *C. fuscus* and *C. albidus*. There can be no doubt that these were practically the same as those alluded to by Schmeil (103) as *C. albidus* var. *distinctus*, Richard, and later as *C. distinctus*, Richard. I further believe that they ought to be called *C. bistriatus*, Koch. The figure and description given by Koch (96) evidently refer to a *Cyclops* belonging to the "*fuscus-albidus*" group, although it is just as certain that neither *fuscus* nor *albidus* is intended. On the other hand what is said about the coloration agrees exactly with what I saw in my specimens of the form now under consideration when they were alive. As stated by Koch the anterior portion of the carapace was finely spotted with brown whilst the posterior thoracic segments and the feet were blue or rather blue-green. To the naked eye the whole animal appeared of a blue-green colour and attracted attention at once as something out of the common.

It has been suggested that this peculiar and rare form is really a hybrid between *C. fuscus* and *C. albidus* and this may indeed really be the case. But although having in general a structure intermediate between *C. fuscus* and *C. albidus* it also possesses some peculiarities of its own (see accompanying drawing of receptaculum seminis and fifth foot), and it is certainly better for the present to consider it as a distinct species than to mix it up in our records with the two species mentioned.

The three localities where this species has been found are a pond by the side of Rectory Lane, Loughton, a pond just north of Ambresbury Banks, and a bog-pond by the side of Lodge Road leading to Copped Hall. All the individuals hitherto seen have been females.

Cyclops serrulatus, Fischer.—Lubbock (48), Brady (16 and 19).

Cyclops ? macrurus, Sars.—Brady (16 and 19). This is a very doubtful Epping Forest species. The specimens seen were males and may really have been *C. serrulatus*, but their caudal rami were so extraordinarily long that reference to that species seemed excluded.

Cyclops prasinus, Jurine.—*C. magnoctavus*, Brady (19); *C. prasinus*, Scourfield (83). Besides the two stations given in Table I., this interesting species has been taken in a pond near Fairmead Lodge, and in another near the "Owl," Leppit's Hill.

Cyclops affinis, Sars.—Brady (16 and 19).

Cyclops phaleratus, Koch.—*C. canthocarpoides*, Lubbock (48); *C. phaleratus*, Brady (16 and 19).

Cyclops fimbriatus, Fischer.—*C. crassicornis*, Brady (16); *C. fimbriatus*, Brady (19).

Family—HARPACTICIDÆ.

Canthocamptus staphylinus, Jurine.—*C. minutus,* Baird (2), Brady (16), Scourfield (82).

Canthocamptus minutus, Claus (not *C. minutus,* Müller). —T. Scott (74), T. and A. Scott (76), Scourfield (85). Two stations, in addition to the two given in Table I., have yielded this little species, namely, a pond near Ambresbury Banks, and a little brook near the entrance to Gilbert's Slade.

Canthocamptus trispinosus, Brady (16).

Canthocamptus northumbricus, Brady (16). This rare species has only been found once in a tiny pool by the side of the Ching Brook near Connaught Water.

Canthocamptus crassus, Sars.—*Attheyella spinosa,* Brady (16), T. Scott (64, Part III.); *C. crassus,* Scourfield (85). Leyton Flats and a pond near Oak Hill have been the only places where this has been found.

Canthocamptus pygmæus, Sars.—*C. cryptorum,* Brady (12); *Attheyella cryptorum,* Brady (16), T. Scott (64, Part III.); *C. pygmæus,* Scourfield (85). It will be seen from Table I. that, next to *C. staphylinus,* this is the commonest species of the genus. The records would not have been nearly so numerous, however, if the practice of washing wet mosses had not been adopted.

Canthocamptus zschokkei, Schmeil. — *Attheyella propinqua,* T. Scott (64, Part III); *A. zschokkei,* T. Scott (64, Parts V. and VII). This species, which is very closely allied to the foregoing, has only been found amongst some wet liverworts in a damp hollow between the "Perch Pond" and "The Lake," Wanstead Park.

Nitocra hibernica, Brady. — *Canthocamptus hibernicus,* Brady (16).

Moraria anderson-smithi, T. and A. Scott (74a).—T. Scott (64, Part III.); *Ophiocamptus sarsi,* T. Scott (64, Part V.), Schmeil (103).

On each of the three occasions when this species has been taken it has been associated with *sphagnum* moss. In addition to Leyton Flats, it has been found in a bog near Oak Hill.

PART IV.

A BIBLIOGRAPHY OF THE LITERATURE RELATING TO THE BRITISH FRESH-WATER ENTOMOSTRACA.

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(2.) BAIRD (W.) *Natural History of the British Entomostraca. Ray Society*, 1850.

(2A.) BAIRD (W.) "Description of several new species of Entomostraca" *Proc. Zool. Soc., London* 1850, pp. 254-7.

(3.) BAIRD (W.) "Notes on the Food of some Fresh-water Fishes, more particularly the Vendace and Trout." *Edinburgh New Philosophical Journal*, vol. vi., 1857, p. 17.

(4.) BAIRD (W.) "Our Fresh-water Entomostraca, Shell-Insects or Water-Fleas." *Popular Science Review*, vol. vi., 1867, p. 42.

(5.) BECK (C.) "On some new Cladocera of the English Lakes." *Journal Royal Microscopical Society*, ser. 2, vol. iii., 1883, p. 777.

(6.) BOLTON (T.) Portfolio of Drawings. 1879-1884. [Contains drawings and descriptions of several species of Fresh-water Entomostraca.]

(7.) BRADY (G. S.) "Entomostraca (Water-Fleas)." *Intellectual Observer*, vol. i., 1862, p. 446.

(8.) BRADY (G. S.) "Species of Ostracoda new to Britain." *Annals and Mag. Nat. Hist.*, ser. 3, vol. xiii., 1864, p. 59; and *Trans. Tyneside Nat. Field Club*, vol. vi., 1864, p. 105.

(9.) BRADY (G. S.) "Synopsis of the recent British Ostracoda." *Intellectual Observer*, vol. xii., 1867, p. 110.

(10). BRADY (G. S.) "Monograph of Recent British Ostracoda." *Trans. Linnean Soc.*, vol. xxvi., 1868, p. 353.

(11.) BRADY (G. S.) "Notes on the Crustacean Fauna of the English Lakes." *Intellectual Observer*, vol. xii., 1868, p. 416.

(12.) BRADY (G. S.) "Description of an Entomostracan inhabiting a Coal Mine." *Quarterly Journal of Micro. Science*, vol. ix., 1868, p. 23.

(13.) BRADY (G. S.) "Contributions to the study of the Entomostraca." *Annals and Mag. Nat. Hist.*, ser. 4, vol. ii., 1868, pp. 30, 178, 220; vol. iii., 1869, p. 45; vol. iv., 1870, p. 450.

(14.) BRADY (G. S.) "Notes on Entomostraca taken chiefly in the Northumberland and Durham District." *Nat. Hist. Trans. Northumberland and Durham*, vol. iii., 1870, p. 361.

(15) BRADY (G. S.) "Micro Fauna of the Fen District." *Nature*, vol. i., 1870, p. 483.

(16.) BRADY (G. S.) *Monograph of the free and semi-parasitic Copepoda of the British Islands. Ray Society*, 3 vols., 1878-1880.

(17.) **Brady** (G. S.) "Notes on Entomostraca." *Fifth Annual Report Fishery Board for Scotland*, 1887, p. 328.

(18.) **Brady** (G. S.) "Description of a new species of *Cyclops*." *Sixth Annual Report Fishery Board for Scotland*, 1888, p. 232.

(19.) **Brady** (G. S.) "Revision of the British Species of Fresh-water Cyclopidæ and Calanidæ." *Nat. Hist Trans. Northumberland and Durham*, vol xi., 1891, p. 68.

(20.) **Brady** (G. S.) "On the British species of Entomostraca belonging to *Daphnia* and other allied genera." *Nat Hist. Trans. Northumberland and Durham*, vol. xiii., 1898, p. 217.

21.) **Brady** (G. S.) and **Norman** (A. M.) "Monograph of the Marine and Fresh-water Ostracoda of the North Atlantic and of North Western Europe." *Scientific Trans. Royal Dublin Soc.*, ser. 2, vol. iv., 1889, p. 63, and vol. v., 1896, p. 621.

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(22.) **Brady** (G. S.) and **Robertson** (D.) "On the Distribution of British Ostracoda." *Ann. and Mag. Nat. Hist.* Ser. 4, vol. ix., 1872, p. 48.

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(31.) **Hammond** (A.) "The Structure and Economy of the *Daphnia*." *Journ. Postal Micro. Soc.*, vol. i., 1882, p. 161.

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(57.) **Quekett Microscopical Club.** "Lists of objects found on the Excursions of the Club." *Journ. Quek. Micro. Club*, vols., iv., v., and vi., 1889-1897. [Contains numerous records of Entomostraca from the neighbourhood of London.]

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Part I., 1890, in *8th. An. Rep.*, p. 334;
Part II., 1891, in *9th. An. Rep.*, p. 269;
Part III., 1893, in *11th. An. Rep.*, p. 220;
Part IV., 1894, in *12th. An. Rep.*, p. 284;
Part V., 1895, in *13th. An. Rep.*, p. 237;
Part VI., 1896, in *14th. An. Rep.*, p. 167;
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(67.) Scott (T.) "*Ilyocryptus sordidus*, Liévin, in Lochend Loch, Edinburgh" *Annals Scot. Nat. Hist.*, 1892, p. 273.

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(74A.) Scott (T. and A.) "On some new or rare Scottish Entomostraca. *Ann. and Mag. Nat. Hist.*, ser. 6, vol. xi., 1893, p. 210.

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(87.) Smith (E.) "*Macrothrix.*" [=*Acantholeberis curvirostris.*] *Science Gossip*, 1870, p. 204.

(88.) Sorby (H. C.) "Detection of Sewage Contamination by the use of the Microscope and on the Purifying Action of minute Animals and Plants." *Journ. Soc. of Arts.*, vol. xxxii., 1884, p. 929.

(89.) White (A.) *A Popular History of British Crustacea*, London, 1857.

(90.) [Anon.] "The apparent disappearance of the British Phyllopods.' *Natural Science*, vol. xi., 1897, p. 79.

Appendix.

LIST OF FOREIGN WORKS SPECIALLY REFERRED TO IN THE PREPARATION OF THIS PAPER.

(91.) Apstein (C.) *Das Süsswasserplankton* (Kiel and Leipzig), 1896.

(92.) Claus (C.) "Uber die Wiederbelebung im Schlamme eingetrockneter Copepoden &c." *Arbeiten Zool. Inst. Univ.* Wien., vol. xi., 1895, p. 1.

(93.) Forbes (S. A.) "Preliminary Report on the aquatic Invertebrate Fauna of the Yellowstone National Park, &c." *Bulletin U.S. Fish Commission*, vol. xi., Washington, 1893.

(94.) Hellich (B.) "Die Cladoceren Böhmens." *Archiv der Naturw Landesdurchforschung von Böhmen*, vol. iii., Prag, 1877.

(95.) Herrick (C. L.) "A Final Report on the Crustacea of Minnesota." *Geological and Nat. Hist. Survey of Minnesota*, 12th Annual Report, 1884.

(96.) Koch (C. L.) *Deutschlands Crustaceen, Myriapoden und Arachniden*, Regensburg, 1835-41.

(97.) Kurz (W.) "Dodekas neuer Cladoceren.' *Sitzungsberichte der Kaiserlichen Akad*, Wien., vol. lxx., 1874.

(98.) Matile (P.) "Die Cladoceren der Umgegend von Moskau." *Bull. Soc. Imp. Nat.*, Moscow, vol. iv., 1890.

(99.) Mrázek (A.) "Beitrag zur Kenntniss der Harpacticiden Fauna des Süsswassers." *Zoologische Jahrbücher* (System. Abt.), vol. vii., 1893.

(100.) Müller (P. E.) "Danmarks Cladocera." *Naturhistorisk Tidsskrift*, Copenhagen, vol. v., 1868.

(101.) Richard (J.) "Revision des Cladocères." *Annales des Sciences Naturelles* (Zoologie) 1894, p. 279, 1896, p. 187. (In progress.)

(102.) Sars (G. O.) "Oversigt af Norges Crustaceer." Part II. (Branchiopoda, Ostracoda, Cirripedia) *Forhandlinger i Videnskabs-Selskabet*, Christiania, 1890.

(103.) Schmeil (O.) "Deutschlands freilebende Süsswasser-Copepoden." *Bibliotheka Zoologica* edited by Leuckart and Chun. Heft xi., 1892 (Cyclopidæ), Heft xv., 1893 (Harpacticidæ), Heft xxi., 1896 (Centropagidæ), Heft xxi., Nachtrag, 1897 (Supplement to Cyclopidæ and Centropagidæ.)

(104.) Stingelin (T.) "Die Cladoceren der Umgebung von Basel." *Revue Suisse de Zoologie*, vol. iii., 1895.

(105.) Vávra (V.) "Monographie der Ostracoden Böhmens." *Archiv der Nat. Land. v. Böhmen*, vol. viii., Prag 1891.

(106.) Vosseler (J.) "Die Krebsfauna unserer Gewässer." Zacharias's *Thier- und Pflanzenwelt des Süsswassers*, vol. i., 1891.

(107.) Weismann (A.) "Beiträge zur Naturgeschichte der Daphnoiden. *Zeitschrift für Wissenschaftliche Zoologie*, vol. xxvii., 1876, vol. xxviii., 1877, vol. xxx. (Supplement) 1878, vol. xxxiii., 1879.

(108.) Zacharias (O.) *Forschungsberichte aus der Biologischen Station zu Plön* Parts I. to V., 893-97.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

MAMMALIA.

Otters in the Lea at Hoddesdon.—The *Fishing Gazette* of May 7th records the capture of two otters (male and female), which were shot near the stone railway bridge, Rye House, Hoddesdon, on Saturday, April 30th, by Mr. Walter Huddlestone, the two weighing over 27lb.—viz., 15lb. and 12¾lb. respectively. Both of them were killed with one discharge from the gun. They were shown and weighed at the "Rye House" Hotel in the presence of the proprietor and several visitors.

The New "Whale Gallery" at the British Museum of Natural History.—One of the latest and certainly not the least valuable and interesting of the innovations at Cromwell Road which we owe to the museum-genius of Sir William Flower is the new Cetacean Gallery—an exhibition of these gigantic mammalia which we suppose is unparalleled in the museums of Europe. Some of the species are demonstrated as "skeleton-models," the external contour of the body being shown by a casting over the actual skeleton on *one side*, the bones being readily seen in proper anatomical position on the *other side*. By this ingenious device, not only can a realistic idea be obtained of the actual appearance and extreme specialization of external form of the living animal, but at the same time correct notions may be gained of the extraordinary modification of the mammalian skeleton exhibited in the whales, particularly of the skull, the fore limbs and the position of the small bones representing the aborted hind limbs. For the first time in the development of the museum idea the student has an opportunity of making a real study of this instructive group, and a visit to the gallery will convince the most sceptical of the immense difference in educational efficiency between mere reading or looking at pictures and the actual sight of these skeleton-models. The ordinary visitor may now form a truthful mental picture of some of the most wonderful of the Creator's handiworks, and upholders of the value of museums will be furnished with another and most convincing concrete vindication Essex claims no less than ten Cetaceans as occasional or constant visitors to her shores, and hence this gallery ought to have special interest to local naturalists—an interest intensified when they see the skeleton-model of the Essex Rudolphi's Rorqual (*Balænoptera borealis*) 35 feet long, which was stranded on the foreshore at Tilbury in October, 1897, forming a conspicuous object in the new gallery. (See Mr. Crouch's paper on this Whale in the Essex Naturalist for 1888, vol. ii., pp. 41-46) – Ed.

AVES.

The Introduction of the Rufous Tinamu *(Rhynchotus rufescens)* **into Essex.**—In 1888 we published in the Essex Natualist (vol. ii., pp. 102-11) a paper by Mr. J. E. Harting on the introduction by Mr. J. Bateman of this bird into Essex, at Brightlingsea, together with a figure and a detailed account of its specific characters, habits, and distribution. Subsequently in the same volume (p. 206) Mr. Bateman gave the latest particulars of the fate of the colony. The original experiment in the acclimatisation of the *Rhynchotus*, however, was not permanently successful, because the Essex and Suffolk Foxhounds left Brightlingsea practically unhunted during 1886-7 and in consequence the foxes and tinamús lay down together—the latter inside. A few wary old bachelor birds survived till 1891, but then disappeared. Mr. Bateman has now, by the kindness of a friend at Buenos Ayres, got a fresh consignment of these beautiful game birds, half of which have already been enlarged in standing beans on the farm of Mr. Frank Girling, of Moverons, and half are being kept in reserve. On the former occasion Mr. Bateman issued a printed card, with a picture of the tinamú, expressing a hope that his neighbours and sportsmen generally in Essex, would refrain from shooting the birds should they wander off his land. This hope he now renews, and certainly such an interesting experiment should be encouraged by all sportsmen and naturalists.

PISCES.

Sturgeon *(Acipenser sturio, L.)* **at Maldon.**—On Monday evening, June 6th, Abraham Sexton and his son, while fishing in a punt on the Blackwater, succeeded in capturing, about 300 yards below the point of the reach, a fine sturgeon, 7ft. 6in. in length, and weighing 1cwt. 2qrs. 24lbs. The fish had apparently come into the shallow water to spawn, and was stranded in mid-stream, the tide being last quarter ebb, so that there was hardly sufficient water to cover it. Sexton struck it with his punt "shoving" stick, and with the aid of his son hauled it into the punt and brought it ashore. The fish was claimed by Mr. F. H. Barbrook, as receiver of Admiralty Droits, on behalf of the Crown, but it was subsequently sold to the captor for a purely nominal sum. The incident is worth recording as the sturgeon is rare in Essex waters.

A Shark at Maldon.—While Arthur and Dick Wright, two brothers, were fishing in the river off Stansgate, on June 4th, they caught what appeared to be a fine salmon. On their attempting to handle it, however, it snapped at them viciously. With the aid of the Coastguard it was eventually dispatched and proved to be a young shark, 4ft. 10in. long, and weighing 84lbs. There appears to be some doubt as to the species, but Mr. Fitch, who saw the fish, says that it is a Toper (*Galeus vulgaris*). It has been preserved by Mr. Sargent, of Maldon, so that there should be no special difficulty in determining the correct name. In the first week in July many young sharks were seen in the English Channel at different points along the S.E. coast, but we have not heard of any special observations on the Essex coast.

BOTANY.

Lathyrus nissolia, L. (the "*Grass vetchling*") **in Essex.**—Hitherto, I have only known *Lathyrus nissolia* as a species growing very sparingly in not a few localities scattered throughout Essex. Never, until now, have I seen it growing anywhere in abundance, though Gibson says (*Flora of Essex*, p. 86) that it grows "plentifully" on the cliffs between Walton and Frinton and that it is "abundant" on the cliffs between Southend and Leigh. On July 7th, however, I was surprised to see it—or what I took to be it—growing in the greatest abundance among the long grass which had been left for hay in a meadow belonging to Sir Duncan Campbell, on the east side of the churchyard and beside the railway line at Bowers Gifford. It was flowering in the greatest profusion.—MILLER CHRISTY, F.L.S., "Pryors," Broomfield. My experience of *L. nissolia* quite accords with Mr. Christy's, I have found it frequently in various parts of Essex, but always solitary plants or very sparsely scattered over a considerable area.—W. COLE.

Alfred Greenwood (? Botanist) of Chelmsford.—In the museum of the Penzance Natural History and Antiquarian Society is a large cabinet containing a very extensive herbarium. The cabinet bears the inscription, "Collected by the late Alfred Greenwood, Esq., of Chelmsford, and presented by his executors." Who was this Essex gentleman whose treasures found a home in far-away Cornwall?—I. C. GOULD, Loughton.

MISCELLANEA.

Annual Conference of "East Anglian" Natural History Societies.—As the report of the meeting at Witham on July 23rd, will not appear until the next part, it may be well to announce at once that the idea of a conference was warmly received by the representatives of the three bodies—the Norfolk and Norwich Naturalists' Society, the Ipswich Scientific Society, and the Essex Field Club—then present. The following resolution proposed by Mr. W. Cole and seconded by Prof. Meldola was unanimously passed:—"That in the opinion of the representatives of the three societies here assembled the establishment of an annual congress is much to be desired, and it is recommended that steps be at once taken to form a committee of the societies to promote such a congress in 1899." The proposal was supported by Mr. T. Southwell, Mr. H. Miller, Dr. Vincent, Prof. Boulger, Mr. W. Whitaker, F.R.S., Mr. D. Howard, Mr. J. C. Shenstone, and others. The *Standard* of July 23rd published a long and inspiring "leader" supporting the proposal, and an admirable article appeared in the *Speaker* of July 30th. A good report appeared in the *East Anglian Daily Times* of July 25th.—ED.

. . THE . .

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THE ESSEX NATURALIST.

The next number will be published in October.

The Editor will be glad to receive "Papers" and "Notes" on the Natural History, Geology and Pre-historic Archæology of Essex, and any contributions likely to be interesting to Field Naturalists generally.

Also books and papers for notice in the Journal, and cuttings and extracts from periodicals furnishing information of the occurrence of uncommon animals and plants, exposure of new geological sections, new well-sinkings, &c., in Essex, &c., &c.

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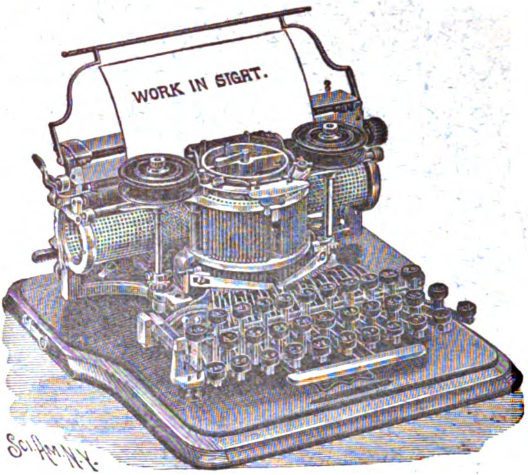
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The
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BEING THE

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OF THE

ESSEX FIELD CLUB.

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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[*Several Papers, Reports of Meetings, &c., remain over until the January part.*]

The authors alone are responsible for the statements and opinions contained in their respective papers.

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ESSEX FIELD CLUB "SPECIAL MEMOIRS," VOL. III.

THE
MAMMALS, REPTILES, AND FISHES OF ESSEX:

BY

HENRY LAVER, M.R.C.S., F.L.S., F.S.A., etc.,

With Eight Full-page and Two Half-page Illustrations by
H. A. COLE and MAJOR BALE.

Price 10s. 6d., nett. Simpkin, Marshall & Co., and Durrant & Co.

UNDER the agreement for the publication of this book, the Council are now enabled to offer a limited number of copies to MEMBERS OF THE CLUB ONLY, at the subscription price of 6s. 6d., post free. Any Member who has not secured a copy of this most useful book to Essex Naturalists should do so at once.

"The book before us deals with the Vertebrates, other than the birds, of the County of Essex: and we may congratulate the Field Club of the County on the charming little work its Vice-President, Mr. Laver, has produced under its auspices, and may hope that so attractive a book may influence other Essex naturalists to take up the study of the groups it treats of. . . . . More than half the book is devoted to the Mammals, and Mr. Laver has given us a number of interesting notes on the habits and local distribution of the smaller members of the class, as yet so insufficiently studied from the field naturalist's point of view. This seems to be the most original part of the work, not depending, as so much of the remainder necessarily does, on 'records,' but on the author's personal observations, and the qualities here shown lead us to hope that we may see further contributions from his pen in this direction. . . . . A last word of commendation may be said for the printing, get up, and arrangement of the book, while many of Mr. Henry A. Coles' illustrations, notably the 'Badger-earth, Epping Forest' (p. 42), are quite charming."—T. O., *Natural Science*, August, 1898.

"In respect of physical conditions Essex is one of the most favourably situated of the eastern counties of England for the possession of a large local fauna, its inland districts presenting variety of station, while it has a large sea-board, forming an estuary into which discharge several more or less important rivers. Indeed, were it not for the pollution of the Thames, the fish-fauna of the county would be even larger than is at present the case, and would reckon among its constituents the lordly salmon itself. Among other special advantages, from a naturalist's point of view, the county includes Epping Forest, which, under its present excellent administration, forms a sanctuary for wild creatures of many kinds. And, in addition to its natural advantages, Essex is fortunate in possessing a Field Club, which includes in its working roll many naturalists of high capacity. It is to a member of this club that we owe the present contribution to a knowledge of the fauna of the county. . . . . The volume is illustrated with several photogravures, all of which are excellent from an artistic point of view, while several afford interesting glimpses of local scenes. If it be regarded merely as a stepping-stone towards fuller treatment, the work may be welcomed as indicating the recognition of the importance of treatises on our local British faunas."—R. L., *Nature*, July 14th, 1898.

Application for copies by MEMBERS under the above arrangement must be made to the *Secretaries, Buckhurst Hill, Essex.* NON-MEMBERS should obtain the book direct from the publishers.

THE ESSEX MUSEUM OF NATURAL HISTORY.

AGREEMENT BETWEEN THE CORPORATION OF WEST HAM AND THE ESSEX FIELD CLUB, AND THE MUNIFICENT GIFT OF MR. J. PASSMORE EDWARDS.

THE position of the Club's County Museum up to December, 1897, was explained in the Reports of the Council for 1896 and 1897 (ESSEX NATURALIST, vol. x., pp. 18-21 and pp. 251-252) and was commented on by our President, Mr. Howard, in his annual address (*ante* p. 245).

At the meeting of the Council of the Club on June 1st, 1897, the Secretary was empowered to make a proposal to the Corporation of West Ham in precisely the same terms as that previously made to the Corporation of Chelmsford, and refused by them. The Corporation through their Library and Technical Instruction Committee received the proposal in a very cordial way, and after obtaining detailed explanation of the scheme, the Committee officially visited the Epping Forest Museum at Chingford, on October 19th, 1897. On that occasion the President, Mr. Howard, and the Secretary demonstrated the principles of the arrangement of the Museum to the Committee and gave information as to the plans which were proposed for the County Museum at Stratford. As a result of these negotiations the Technical Instruction Committee reported at the meeting of the Town Council of West Ham, on the 26th of October, that they "were decidedly of opinion that it would be advantageous to the Borough if arrangements could be made for the establishment of the County Museum at the Technical Institute as proposed by the Club."

The original proposal was that rooms should be given in the Technical Institute for the accommodation of the Museum, but in the course of a long conference with the Committee in the unfinished building on October 25th, it was seen that considerable difficulties would arise on the score of space available for the purpose, and the final decision of the matter was deferred.

In the meantime, the Secretary called upon Mr. Percy Alden, the then Chairman of the Technical Instruction Committee and now Deputy-Mayor, in order to confer with him as to the wishes and plans of the Club. Mr. Alden gave the question most kind and appreciative consideration. It was felt that a separate building was really needed, and after full discussion of ways and means, Mr. Alden offered to write to Mr. Passmore Edwards and place the matter before him. Mr. Edwards' reply was most favourable, and at a meeting of the Town Council on Tuesday, November 23rd, the Technical Instruction Committee were enabled to report as follows :—

" That since their meeting on October 20th, when they reported that they were of opinion that it would be decidedly advantageous to the Borough if arrangements could be made to establish a county museum at the Technical Institute, as proposed by the Essex Field Club, they have had an interview with Mr. David Howard, J.P., the president, and Mr. W. Cole, the hon. secretary, at the Institute, when those gentlemen were shown over the building, and the plans were explained to them. At this interview it was evident that some difficulty would be experienced in affording the Club sufficient and suitable accommodation for the Museum, and it was determined to adjourn the matter for further consideration. In the meantime the Deputy-Mayor has been in communication with Mr. J. Passmore Edwards, and has received from that gentleman a letter, of which the following is a copy :—

November 12th, 1897.

DEAR MR. ALDEN,

In answer to yours on the 9th inst., I beg to say that your suggestion to provide a museum in West Ham, adjacent to the Technical Institute, to accommodate the Essex Field Club's magnificent collection, is worthy of practical adoption, and I willingly comply with your request to provide the necessary building at your estimated cost of £2,500, on condition that it becomes municipal property to be maintained in perpetuity by the Corporation, and that it be opened on Sundays. Besides meeting the requirements of the Essex Field Club, I think you might utilise the proposed museum by holding or having occasional loan collections from South Kensington and other places, and so assist to educate and brighten the lot of the working population of your populous district.—Yours faithfully,

J. PASSMORE EDWARDS."

The Deputy-Mayor also reported that he had been in communication with Messrs. Gibson and Russell, who had informed him that they considered that a suitable building could be erected adjoining the Institute and abutting on the shops in Romford-road. Your committee are of opinion that Mr. Passmore Edwards' munificent offer removes the difficulties in the way of an arrangement with the Essex Field Club, and recommend that it be at once accepted, and that the best thanks of the Council be accorded to Mr. Passmore Edwards for his generosity. They further recommend that Messrs. Gibson and Russell be directed to prepare plans for a suitable building for a museum, at a cost not exceeding the sum named in Mr. Edwards' letter, with a view to its erection in time for opening with the Institute ; also that the proposal of the Essex Field Club with regard to the museum be generally accepted, subject to a satisfactory agreement as to matters of detail, and that it be referred back to your committee to consider and bring up for the approval of the Council, a scheme of arrangements."

The report was passed unanimously, and the heads of the agreement were accordingly prepared by the Secretary of the Club in strict accordance with the proposals originally placed before the Corporation of West Ham. The Agreement was finally settled by Mr. Dare, the *Hon. Counsel*, and by Mr. H. I. Coburn, the *Hon. Solicitor*, in consultation with the *Town Clerk* of West Ham, Dr. Hilleary. It was approved by the Town Council and by the Council of the Club, and was signed and sealed on July 25th, 1898. By order of the Council, a full copy of this important document is set out below for the information of the members.

The Corporation were advised that it was necessary to obtain Parliamentary powers enabling them to enter into the agreement with the Club, and to acquire land on which to erect the museum, and the following provisions were included in the West Ham Corporation Act, 1898, which received the Royal assent at the end of last session. After alluding to the purchase of "The Green," Stratford, for the purposes of the Technical Institute, the preamble proceeds :—

"And whereas an offer has been made to the Corporation of a contribu-"tion to the cost of erection on part of the land so purchased and on a site "adjoining of certain buildings (hereinafter called 'the Museum Buildings') "subject to a condition (amongst others) that the said buildings shall be used "as a museum for the accommodation of the collections of the Essex Field "Club (hereinafter called 'the Club') and it is expedient that the Corporation "be empowered to acquire compulsorily the said site for the purpose of such "buildings and to erect and utilise such buildings accordingly."

Under Section 27 of the Act the Corporation acquire power to take :—

"For the Museum buildings. Certain lands in the Parish and Borough "of West Ham in the county of Essex, situate on the north side of the Rom-"ford Road, known as No. 103 in that road."

And under Sections 52 and 53, the following powers are conferred :—

"52 The Corporation may appropriate for the purpose of a building "for the accommodation of any collections of instruments, specimens, maps, "books, pictures, engravings, articles, and things of the Club and other "purposes of a museum, any portion of the land known as 'The Green, Strat-"ford,' referred to in part V. of the Act of 1893, and may erect thereon and on "the lands shown on the deposited plans and known as 103, Romford Road, a "building to be used as a museum and for the accommodation and exhibition "of such collections in accordance with any agreement which may be entered "into between the Corporation and the Club and may accordingly fit up "furnish and maintain such building for such purposes and employ attendants "in connection therewith and may from time to time pay such attendants "such salaries or other emolument as they think fit."

"53. The expenses of the maintenance and management of the museum "and museum buildings may be defrayed in the manner provided by Section "36 of the Act of 1893 with respect to the expenses of the Technical "Institute and Public Library, and all expenses incurred by the Corporation "under this part of this Act or in pursuance of any agreement made there-"under and not so defrayed (other than the cost of erecting the museum build-"ings) shall be paid out of the Borough fund."

Some negotiations took place between the Technical Instruction Committee and Mr. Howard, Mr. Cole, and Professor Boulger representing the Club, in consequence of an alteration of the plans of the building by the Architects. Ultimately it was decided that the Club should have the whole of the ground floor (comprising the vestibule, the large hall, a smaller hall, and an alcove out of the large hall, together with a special room for the library and other offices) and one-half the basement. The Corporation to retain the whole of the galleries. The cost of the building as finally settled by the Architects, Messrs. Gibson and Russell, was computed at more than double the original estimate. The final settlement of the arrangement was announced by the following letter from the Town Clerk:—

"TOWN HALL, WEST HAM, E.,
30th July, 1898.

"DEAR SIR,

"Adverting to your call here on Monday last I now beg to inform you "that the Council have approved the altered plans for the Museum Building "in the Romford Road which were then submitted to you, and have given the "Architects the necessary instructions to proceed to obtain tenders for the "erection of the building at an estimated cost of £6,000.

"I am, dear Sir,
"Yours faithfully,
"FRED. E. HILLEARY.

"W. COLE, ESQ.,
"Essex Field Club, Buckhurst Hill."

As above stated, the site of the Museum is adjoining the magnificent Municipal Public Library and Technical Institute, which now forms so conspicuous an ornament to the main (Romford) road out of Stratford. On Thursday afternoon, Oct. 6th, after opening the Institute, Mr. Passmore Edwards, at the invitation of the Mayor (Alderman W. Ivey), and in the presence of the Chairman of the Technical Instruction Committee (Alderman W. Crow, J.P.,) the members of the Corporation, and a large concourse of visitors, laid the first stone of the Essex Museum of Natural History. Mr. David Howard, J.P., in proposing a vote of thanks to Mr. Edwards for his enlightened generosity shown on more than one occasion in the Borough, and now in providing so largely for the erection of the Museum, said that the Club would endeavour to make the collections worthy of Mr. Edwards and of the building in which they were to be placed. [Hear, hear.] He also handed to him a copy of the resolution passed at the special meeting of the Club, on October 4th, to the following effect :—

> "That Mr. Howard, as President of the Essex Field Club, be asked to convey to Mr. J. Passmore Edwards the cordial and grateful thanks of the Club for his munificence in contributing so readily and so largely towards the erection of a suitable building for the projected Essex Museum of Natural History, and at the same time to express the Club's high appreciation of the value of the impetus thus given to the important cause of local museums."

Mr. Councillor Boardman seconded the vote of thanks, and remarked that he hoped the friendship between Mr. Passmore Edwards and the Borough would deepen and widen. They were looking forward to the future of that Museum, and were delighted to think that it would be the Head-quarters of the Essex Field Club. [Hear, hear.]

The motion was carried unanimously.

In reply, Mr. Passmore Edwards said that this being a county Borough the Museum would belong to the county of Essex more than to West Ham itself. He trusted that the two institutions, the Technical Institute and the Museum, would stand side by side as part and parcel of one great whole, and that they would mutually work with each other. He could only wish them both great prosperity and usefulness. [Loud applause.]

The business details relating to the removal of the Club's collections from Chelmsford must be left to the Council to explain in their Annual Report. It will be sufficient to state that the Sub-Committee appointed by the Council having come to an arrangement with the representatives of the old Chelmsford Museum Society, the rooms at Chelmsford have been given up and the property of the Club is now stored in a suite of rooms at

9, Woodgrange Road, Forest Gate, which have been hired by the Council for this purpose and to serve as the Curator's workrooms until the new Museum is ready for the reception of the collections. At a Special Meeting of the Club held on October 4th, 1898, the following resolutions were duly passed and now form part of the Rules of the Club :—

(*a*) "That the first ten words in Rule xxv. be altered so as to read: –'The Museum and Library shall be situated in Essex,' and that consequent alterations be made throughout the Rules."

(*b*) "That the Mayor, Aldermen, and Burgesses of the County Borough of West Ham (hereinafter called the Corporation) having offered on the terms of an Agreement bearing date the 25th day of July, 1898, and made between WILLIAM COLE, the Secretary of the Club of the one part, and the Corporation of the other part, to provide in a building to be erected by J. PASSMORE EDWARDS, Esq., on land to be acquired by the Corporation, accommodation for the reception and exhibition of the instruments, specimens, maps, books, pictures, engravings, articles, and things of a scientific, artistic, antiquarian, or topographical character now belonging to the Club, other than and except such of them as are known as the Epping Forest Collection, all the said instruments, specimens, maps, books, pictures, engravings, articles, and things, except the said Epping Forest Collection, shall, on completion of the said building and notwithstanding anything contained in the Rules of the Club, Nos. 1 to 36 both inclusive, be removed thereto to be held and dealt with and managed under the regulations and conditions contained in the said Agreement.

(*c*) "That notwithstanding anything contained in the hereinafter-mentioned Rules of the said Club, the said Agreement shall be binding on the said Club and Members and Trustees thereof, and on the property thereof and be carried into effect, and the said WILLIAM COLE shall be entitled to indemnity out of the funds and property of the Club against liability under the said Agreement, and any costs or expenses he may incur by reason of his having executed the same.

(*d*) "That the aforesaid Resolutions be Rules of the Club, and be inserted after Rule 36; and be numbered 36a and 36b, and Rules 1 to 36 inclusive be binding and effectual only so far as they are not inconsistent with Rules 36a and 36b or either of them."

At the same meeting, the cordial thanks of the Club were passed to Mr. H. I. Coburn, the *Hon. Solicitor*; Mr. W. C. Dare, the *Hon. Counsel*; to the *President* (Mr. Howard), and to the *Hon. Secretary* (Mr. W. Cole), for their great care and trouble in conducting the negotiations which had brought this most important matter to so successful a conclusion. The best thanks of the Club are also due to the Technical Instruction Committee of West Ham for the wise and enlightened view they had taken in this matter, and particularly to Mr. Councillor Percy Alden, M.A., for his great services in connection therewith.

To prevent misapprehension, it should be stated that the County Museum is quite distinct from the Club's Epping Forest Museum, which is established at Queen Elizabeth's Lodge, Chingford, under the sanction of the Corporation of London. It is hoped that the two Museums may be mutually helpful, the one being complementary to the other.

Further progress will be reported in succeeding parts of the ESSEX NATURALIST, and a paper on the objects, proposed arrangement and mode of working the Museum, with plans and full details, will be put before the members in due time. The appeal for the "Museum Purchase Fund" will also very soon be issued.

Mr. W. Cole, F.L.S., F.E.S., has been appointed Curator, and all enquiries respecting the Museum, donations of specimens, &c., should at present be addressed to him at Buckhurst Hill, or at 9, Woodgrange Road, Forest Gate, Essex.

[*Endorsement.*]

Dated 25th July, 1898.
THE WEST HAM CORPORATION
and
THE ESSEX FIELD CLUB.
Agreement as to the MUSEUM of the ESSEX FIELD CLUB.

An Agreement made the twenty fifth day of July one thousand eight hundred and ninety eight **Between** the MAYOR ALDERMEN and BURGESSES of the COUNTY BOROUGH of WEST HAM (hereinafter called the Corporation) of the one part and WILLIAM COLE of Buckhurst Hill in the County of Essex the Secretary and Curator to an Association of persons known as the Essex Field Club (hereinafter called the Club) of the other part. **Whereas** J. Passmore Edwards, Esq. has offered to contribute the sum of £2,500 towards the erection of a building adjacent to the Corporation's Technical Institute in the Romford Road Stratford Essex on land to be acquired by the Corporation on certain conditions including a condition that a portion of the said building shall be devoted to the accommodation of the Club's collections. AND WHEREAS such offer to contribute to the erection of a building has been accepted by the Corporation on the said conditions. **Now it is hereby agreed** between the parties hereto as follows:—The said William Cole undertaking and agreeing for the performance and observance of the stipulations hereinaftei expressed or appearing to be performable and observable by the Club.

(1) **The** Corporation shall devote the whole of the ground-floor and one half of the basement of the said building solely to the purpose of a Museum

for the reception accommodation and exhibition of the instruments specimens maps books pictures engravings articles and things of a scientific artistic antiquarian or topographical character now belonging to the Club other than and except such articles and things as are known as the Epping Forest Collection all which articles and things with such exceptions as aforesaid are hereinafter referred to as the Club's general collection and shall provide for the due warming lighting cleaning and caretaking of the said Rooms and on completion of the said building the Club shall remove thereto and keep therein all its said general collection and shall thereafter place and keep in the said rooms all additions which shall be made to the said general collection.

(2) **The** Corporation shall as from the date of these presents pay to the Treasurer for the time being of the Club as a contribution to a fund to be called the "Museum Maintenance Fund" which shall be forthwith established by the Club the yearly sum of one hundred pounds by equal payments on the 24th day of June and the 25th day of December in every year the first of such payments or a proportionate part thereof to be made on the 25th day of December next. The Museum Maintenance Fund shall be devoted to defraying the Curatorial and Management expenses incurred by the Club or its officers in carrying on the said Museum.

(3) **The** Club shall have the control of the said general collection and the cases and cabinets in which the same may be contained and the acceptance selection arrangement and scientific management of the contents of the said Museum whether of a permanent character or temporary or loan collections or exhibitions and shall have the right of appointing and shall appoint and employ as its own officer a person to superintend arrange and manage the said collection to be called the Curator. The Club may dismiss any Curator and appoint another from time to time but shall always keep some person employed in that office. The Corporation shall retain the control of the building subject to the use of the said rooms as aforesaid and shall have the right to determine the terms and times on and at which respectively the Museum shall be open to the public and other details connected with the use of the Museum as a public institution and shall carry on such control by means of its own officers and servants.

(4) **The** Corporation shall allow the Club to deposit its Library in the Museum buildings the said Library being the property of and under the sole control of the Club.

(5) **The** said Building shall be open to the Curator and to Members of the Club every day between the hours of ten a.m. and nine p.m. and the Corporation shall provide for the opening of the building to the Curator and the Members of the Club on days and at times between the said hours although the public may not be admissible.

(6) **The** Club shall do its best to extend the collections to assist the Curator in the arrangement and improvement of them and will ask its expert members and friends to join in the work to the best of their ability so that the scheme of a County and Educational Museum set forth in Clause 10 of this Agreement may be carried out in the best possible way.

(7) **The** Club shall pay and contribute Fifty pounds per annum to the Museum Maintenance Fund in addition to any annual or other donations which may be subscribed or given to the Club for the special purpose for

which the Museum Maintenance Fund is established by individual members of the Club or other persons. The said annual contribution of Fity pounds shall commence as from the date of this Agreement. All such annual or other donations shall be carried by the Treasurer of the Club to a separate account to be called the "Museum Maintenance Fund" and the Club shall cause to be prepared and presented to the Corporation annually an account of all contributions receipts and payments to for and out of or on account of the said Fund.

(8) **The** Club will endeavour to raise by public subscription or otherwise in as short a time as may reasonably be possible a Fund to be called "The Museum Purchase Fund" and the amount of the Fund which the Club is so enabled to raise shall be applied in the purchase at the discretion of the Council of the Club of additions to the said general collection of articles and things of a nature hereinbefore mentioned to be comprised in such collection and for the obtaining of special expert assistance in determining and arranging collections and other expenses of a like nature which may be required in the Museum.

(9) **The** Club will as heretofore keep the said general collection and all additions thereto covered by Insurance against loss by fire and will apply any moneys received under such Insurance in replacing as far as possible such articles and things as shall be destroyed or damaged by fire.

(10) **The** Museum shall be primarily a local museum serving to illustrate in the most scientific and modern manner possible with the means at command the biology geology meteorology topography ethnology pre-historic and other antiquities agriculture fisheries manufactures industries of Essex and the neighbouring sea rivers and border lands. The Plan of the Museum may also include illustrations of local antiquities and views pictures maps of local interest as well as occasional loan collections and exhibitions. In addition to the purely local collections the Museum may contain as funds and space will permit an educational series of specimens and preparations and any objects serving to illustrate the history use or development of minerals rocks animals plants fossils and antiquities but in the selection and exhibition of such specimens the primary object of the Museum shall always be kept in view. Also the purely local character of the Museum shall be subject to the following exceptions:—

(*a*) That specimens appertaining to classification anatomy development distribution et cætera of animals and plants fossils minerals antiquities need not necessarily be of Essex origin but may be specimens from any locality British or Foreign selected with the view of securing the best illustrations possible of the fact or principle desired to be elucidated.

(*b*) That the Museum may contain specimens or collections of British or Foreign natural history geology antiquities provided that they are or can be preserved so that they may be kept in cabinets or otherwise entirely distinct from the Essex series and provided also that they do not limit or interfere with the primary objects of the Museum as a local collection.

(11) **If** within the period of twenty one years from the death of the survivor of the now living descendants of Her Majesty the Queen the Club

shall cease to exist or if within such period the Club shall fail to perform or observe any one or more of the stipulations herein expressed or appearing to be performable or observable by them for the space of six calendar months after notice of such failure shall have been put up by the Corporation in the Museum then and in either of such cases the contents of the Museum shall become the property of the Corporation and the Corporation shall thereafter and thenceforth preserve and carry on the Museum as a permanent Institution and as a Local (Essex) and Educational Museum on the lines of the scheme laid down in Clause 10 of this Agreement.

(12.) **The** Corporation have been endeavouring to purchase some freehold property for the erection of a Museum and from the negotiations it appears that the land is subject to certain covenants which cannot be removed and which might interfere with the Corporation using the land for the above-named purposes. The Corporation will at their own expense during the present Session apply to Parliament and endeavour to obtain powers authorizing them to build notwithstanding such Covenants. In the event of such powers not being obtained on or before the thirtieth day of August one thousand eight hundred and ninety eight this Agreement shall thereupon become absolutely void.

In Witness whereof the Corporation has caused its Corporate Seal to be hereunto affixed the day and year first above written.

The Corporate Seal of the Mayor Aldermen and
Burgesses of the County Borough of West Ham
was hereunto affixed in the presence of
W. Ivey
Mayor
Fred. E. Hilleary
Town Clerk

L.S.

ON THE PREPARATION OF MARINE ANIMALS AS TRANSPARENT LANTERN-SLIDES.

By H. C. SORBY, LL.D., F.R.S., F.L.S., &c.

[*Being Abstract of a Lecture delivered to the Club on May 21st, 1898.*]

THOUGH for some years I have prepared mounted animals by various chemical methods, it is only quite recently that I have seen the importance of a more complete development of such processes; and the cause of some of the reactions still remain to be explained. In all cases the specimens are properly arranged and dried on the glass, and almost always soaked in benzole and then mounted in Canada balsam, which not only makes them far more transparent, but preserves them from mites, and from the growth of mould, which soon occurs unless they are kept very dry. Of course the great aim should be to show, not merely the general form and colour, but also as much as possible of the anatomical structure. To accomplish this many different methods are necessary in the case of different animals; but, on the whole, independent of partial dissection, they may be classified under five divisions, viz.:—

(1.) Animals which may be dried and mounted in their natural state, and need no special precautions to preserve their original colour.

(2.) Those which require special treatment to retain their natural colour.

(3.) Animals which must be stained in various ways, in order to properly show their structure, or to make them permanently of the true colour.

(4.) Animals which could not be properly mounted unless previously decalcified by acids.

(5.) Those from which it is desirable to remove some of the natural or acquired colour, in order that it may not obscure their structure.

There are indeed cases in which it is better to combine two or more of these processes, and in describing the specimens it is not desirable to keep strictly to the above divisions.

In the first instance my aim was to mount the animals merely for use as lantern slides, but lately I have been endeavouring to so prepare them that they may be successfully photographed. This materially increases the difficulties, since a specimen may show extremely well in the lantern, when the colouring is such as to make it almost impossible to produce a good photograph.

Though nearly all the slides I propose to show were prepared with material collected on the coast of Essex, they are now exhibited merely to illustrate methods, and it may be well to briefly describe them in order.

The simple Ascidian, *Cione intestinalis*, is a good example of an animal which needs neither staining nor special precaution to preserve the colour. Some specimens of *Sabella* also give excellent results, but when required for photographic purposes it is well to reduce the general colour of the body by long keeping in alcohol, and to stain the plumes, which otherwise might be too pale, with log-wood. Small specimens of the beautiful Medusa, *Chrysaora*, are sometimes naturally coloured so as to make excellent slides, though it may be necessary to slightly tint the outline of some portions, which otherwise would be invisible. The Lob-worm, *Arenicola*, is often much too dark to give good results, but pale specimens, partially dissected, show the entire structure to great advantage, the blood in the chief vessels retaining its natural colour without sensible change.

The beautiful purple Nudibranch, *Eolis*, contains a pigment easily dissolved out by Canada-balsam, but the colouring is retained perfectly for many years, if protected by the animal being well soaked with gum-Arabic, to which a little glycerine has been added to prevent undue brittleness.

The Slender Spider-crab, *Stenorhynchus*, varies much in different localities. Sometimes it is much too dark, but in one year, in the Orwell, it was very pale and the shell comparatively soft, and covered with parasites, which, however, would not have been well seen unless somewhat stained with log-wood, so as to be of about the natural colour. In mounting Crustacea, the principal difficulty is to get rid of the included air, but this may be done by carefully pricking with a sharp, fine needle, when the specimen is in benzole.

Priapulus should be killed by fresh water, and kept in it until it has become limp, since otherwise it contracts laterally, and shows little of its proper character. It may also be necessary to slightly stain it. Most excellent preparations may be made by cutting open the body longitudinally, staining it, and spreading it open, so as to show the internal anatomy and the whole muscular structure.

It is difficult to prepare good specimens of *Cirratulus borealis*, since they are often too dark and opaque. My best results have been obtained by killing them in fresh water and leaving them in it until they have swollen considerably, but are not decomposed. By this means they may be mounted so as to show the remarkably convoluted intestine, and the chief blood vessels filled with red blood. The cirri should be cut off and stained with carmine, so as to be of the natural colour of the living animal, and mounted on the glass after the body has been dried.

My specimens of *Synapta* have been obtained in the Orwell, outside this county. I exhibit them in order to show the great advantage of proper staining. In one specimen the animals were kept for a considerable time in alcohol, with a somewhat diluted solution of madder, so as to penetrate internally. By this means the tentacles, the intestine, the ovaries, and the chief muscular bands are well seen. In another slide the animals have been cut open longitudinally, stained with carmine, and spread open. In these the above-named structures are well seen, and also the oviducts filled with ova.

I cannot show better illustrations of the advantage of proper staining than different species of Medusidæ. They should be at once put into formalin diluted with about nine times its volume of water, and deposited for some time in a fresh solution, in order to remove all the sea-salts. Without staining most species would be far too transparent and colourless. Good results may be obtained with *Aurelia aurita* by staining with carmine, and on the whole I think it is better to add a little sulphurous acid to the solution. The general character is then shown to great perfection; and in some specimens the anatomical structure of the testes, ovaries, and eyes is well seen. I have also obtained excellent results by staining with port wine in diluted alcohol. In some cases it is impossible to arrange *Aurelia* so as to show a side view in proper perspective, but I have succeeded by keeping the animal in diluted alcohol with picric acid, which, when of proper strength, causes the specimen to be sufficiently plastic to take the desired form.

Small *Cyaneæ* make excellent slides mounted on their sides and stained with methalin blue, so as to be of nearly the natural colour of some individuals. All my good specimens of *Rhizostoma* have been collected in the Crouch near Burnham. Their general characters are excellently seen when stained with carmine, the net-work structure and the eyes being well shown. The detailed structure of *Cydippe* is well brought out by keeping the animals in diluted formalin, and staining with carmine. By careful management most excellent results may be obtained.

I now proceed to cases in which it is necessary to decalcify the animals with dilute acids. As an example, I select *Scrobicularia piperata* stained with carmine. This shows to great perfection the form of the shell and almost the entire anatomical structure of the animal. For many years I never attempted to prepare slides of *Pagurus* (the Hermit Crabs), but more excellent results may be obtained by keeping the animals in diluted sulphurous acid to dissolve out the carbonate of lime and reduce the colour. The general form and structure of the legs and claws is well shown, and the muscles which work them are perfectly visible, being stained by the pigment which was dissolved out from the shell when kept in alcohol. The dark eyes are very conspicuous in the partially developed attached bunch of eggs.

Lastly, I describe cases in which it is desirable to remove some of the pigments by bleaching. *Sepiola*, like several other animals, acquires a spurious brown colour on keeping, which more or less completely hides the true structure. I hope to find some method which will prevent this change, but so far my best results have been obtained by removing much of this colour by keeping for some time in dilute sulphurous acid the animals which had been allowed to die in salt-water with their pigment cells contracted. By this means I have been able to prepare specimens showing the detached pigment cells, and a good deal of the internal structure.

Some remarkable results may be obtained with small flat fish, especially plaice. When mounted in their natural state, the distribution of the blood vessels is a good deal obscured by the bones. If the fish are first kept in alcohol, and afterwards in diluted sulphurous acid, the earthy matter of the bones is removed, the thickness of the specimen is much reduced, and the colour made paler, so that the blood-vessels are fairly well seen. It is, however, far better to put the newly caught animals into diluted formalin, and afterwards keep them for some weeks in diluted sulphurous acid exposed to strong light. By this means the general colour is much reduced, and when dried and mounted many of the blood vessels and the general structure are displayed. The action of the formalin differs considerably from that of alcohol, since the dried muscular tissue shows beautiful interference colours when illuminated obliquely, which is not the case if the animals have been kept in alcohol.

In what I have said, I have confined myself mainly to the more or less chemical part of my subject, but the successful mounting of the preparations involve many mechanical details. Moreover, when the animals are properly arranged and so dried on the glass as not to be distorted by irregular lateral shrinkage, much management is sometimes necessary to mount them in balsam entirely free from bubbles of air. To describe all the details requisite in different cases would, however, make this communication much too long, and would require another class of illustrations.

OBSERVATIONS ON THE IMPLEMENT MADE FROM A DEER'S ANTLER IN THE MUSEUM OF THE ESSEX FIELD CLUB.

By EDWARD LOVETT.

[*Read October 1st, 1898.*]

IN reference to the interesting description of a stag's antler implement in the last part of the ESSEX NATURALIST (*ante* p. 311), by Mr. Worthington Smith, I am inclined to think that the tool was intended for a *Bark-peeler*, as suggested by Mr. Read, though I see no reason why it should not have been used as a pottery-smoother as well.

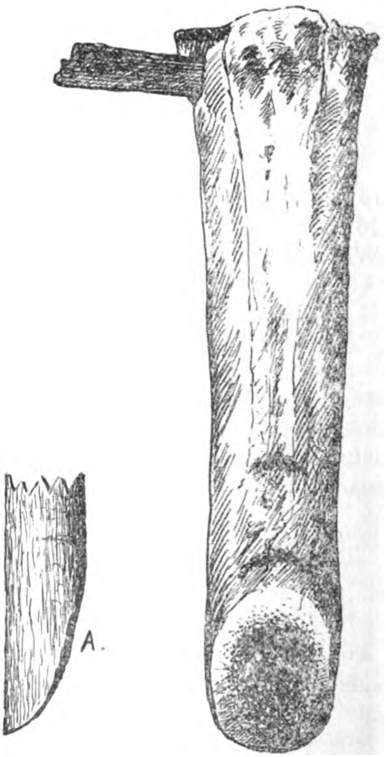
Our ancestors of the pre-historic period no doubt had the little failings which some of us inherit, one of which was to use the first thing that came to hand, provided it was suitable, and I fancy many of their tools served more than one purpose.

In our day how often you see a boy cracking nuts with a hammer; I have myself used a stone for a hammer in my garden, when the procuring of the hammer proper necessitated a walk to the tool-house; whilst the hand loom weavers in some parts of Ireland actually use as a "rubbing-bone" a glazed earthenware cup originally made for holding blacking, but now sold for the purpose aforesaid.

Such instances are abundant; but to return to our implement. Some of the northern tribes of the North American Indians used "Bark-peelers" of bone and elk horn very similar in form to the Wormingford example, whilst the Swiss Lake-dwellings yield adundant examples of tools which were probably used for this and other purposes. It is, however, in instances where implements of early type still survive that we meet with the best evidence of the probable use of objects of pre-historic age about which we may have our doubts.

The annexed drawing is made from a bone implement in my collection which I obtained only this year in Normandy.

I was sauntering round one of those delightful street-markets in an old Norman town, where, amongst others, were some very poor vendors of scrap-iron, old tools, &c.—a veritable *El Dorado* for the antiquary—when I saw this bone implement, brown and polished by age and long use, and having the rusty blade of a pocket knife inserted at the unworked end, the other end being ground to an edge, as in the specimen described by Mr. Worthington Smith. (The bone appears to be ox.)



Chisel-shaped Bone, used for barking birch-trees, Normandy (*one-half natural size*).

A. Side view of end of implement.

I asked the poor old man who was in charge of this miscellaneous stall (the things were all laid out on the roadway) what it was; and he explained that it was used for getting the bark off birch trees.

This I pretended to doubt, calling attention to the bit of iron: whereupon he gave me an object-lesson as to its use, cutting an imaginary slit with the knife blade, then reversing the implement and inserting the sharpened end, running it up and down, thus wedging off the bark, and of course naturally producing the transverse striæ to which Mr. Read's remarks in the ESSEX NATURALIST, p. 312, refer. I asked the stall-keeper the price of this bone, and after a discussion with his wife, which really was as to how high he could go with safety, he nervously suggested ten sous: and I never saw a man more astonished than he when I paid it. I asked if they used them now, and he said, "No; they had not been used for many years."

Birch bark is still used for small boxes, &c., and especially for snuff and tobacco boxes, many of which are very artistic.

From my own experience, I feel sure that in many an old-world continental town may still be picked up primitive objects and tools, which are direct descendants from those of the Stone Age, but which are fast disappearing before the relentless advance of cheap machine-made appliances.

FURTHER NOTES ON THE OCCURRENCE OF CREPIDULA FORNICATA, L., IN ESSEX WATERS.

By WALTER CROUCH, F.Z.S.

AS recorded in the proceedings of the meeting on May 21st, Dr. Laver presented to the Museum a very fine specimen of *Crepidula fornicata* which had been dredged up attached to a large stone, from the River Colne. The specimen was living when Dr. Laver received it, and had a mass of ova inside the shell. At the meeting Mr. Crouch made some observations concerning the mollusc, which are embodied in the following summary:—

Since the publication of my notes in February, 1894, on the introduction of this species into our native fauna (see ESSEX NATURALIST, vol. viii., pp. 36-38), I have received, or personally taken about thirty specimens, mainly from the oyster layings in the River Crouch; some being adherent to oyster shells and others to stones, and in 1896 I discovered two full-sized specimens on oyster-shells dredged from the River Colne, between Brightlingsea and the Pyefleet. It is interesting to find that yet another has occurred in this river. Dr. Laver's specimen is certainly the largest which has yet been taken (measuring about 51 by 40 mm.), while the presence of a mass of yellow spawn yields further proof that the mollusc is quite acclimatised and that it now breeds in our waters.[1]

In my former notes is recorded the presence of eggs in a specimen taken on April 15th on a stone, which is still in my possession, and since then I have had several of these molluscs in a "baby" condition, the youngest measuring 8 mm., which were presented with a selection of four other shells to the British Museum of Natural History.

Of the two Colne specimens of *Crepidula*, one is the largest ever taken by me, measuring 43 by 33 m.m., while the other is 37 by 27 m.m. Like the "monster" of Dr. Laver, the former has but a tinge of fawn-brown colour, while the latter is of a darker brown inside, with a series of marginal spots, and has the epidermis on the exterior, through which the rayed mottlings can be perceived.

In the general structure of the animal (which is attached to the shell by the *septum*) and in the enamelled concave surface, there appears little variation; but the shells exhibit very considerable differences in size, in proportion of width to length, in colouration, and in convexity; these conditions being determined by the shape and surface of the stone or shell to which they adhere, and on which the 'scar' or pallial line may always be traced, the enclosed surface of their attachment being quite smooth.

The epidermis or outer membrane of the shell is often partly or wholly wanting, being either worn away, except on the outer edges, or as sometimes happens through another of the same mollusc being perched upon the top, and in some cases very nearly as large.

It would appear that the animal leads a very sedentary existence, and probably never removes (unless compelled) from its first attachment. I have, however, one shell which has certainly changed its base of attachment, with the curious result that there is a partly double shell, a fresh growth having been formed to fit the new basal curve.

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[1] At the Meeting on September 9th, 1897, Mr. W. M. Webb exhibited a specimen attached to a foreign oyster laid down at Brightlingsea (see E.N., *ante* page 227).—ED.

The septum within is invariably of pure enamel white, with out a trace of colour; but the other portions differ much in tint, though always bearing a glossy enamel. In some the interior is of a rich dark-brown; others the same, with splashes of the pigment and often spotted around the margin; while others are marked with radiating bands.

The contour of some shells shows a deep excavation, including even the septum; but all modifications of shape are comparable in every way with the *parent* species in North American waters.

SOME FURTHER NOTES ON THE EFFECTS OF THE GREAT TIDE OF NOVEMBER, 1897.

By PERCY CLARK, B.A.

SINCE my short account of the encroachments by the sea on our Essex coasts, which was written in the spring of this year 1898, and appeared in the last part of the ESSEX NATURALIST (*ante* pp. 297-9), I have had an opportunity this summer of examining again the scene of the floods and destruction which then took place.

It may be said with truth that during the November gale, 1897, the whole of the low-lying seaboard of Essex and its neighbourhood was for the time being completely submerged. In most cases, after the tide subsided, the overflow gradually disappeared. In some cases it did so in a day or two, in a great many it took weeks, but everywhere the cereals, and in places the pasturage, were destroyed or seriously damaged. Strenuous exertions in repairing the walls as soon as possible met their reward in being the means of saving the country from a second deluge in the succeeding storms of the spring. But at a great many points the breaches were too large to be effectually dealt with at once, and the sea-water continued to flow in and out for months together. Of these more or less permanent and more serious cases I send a few notes.

Taking the coast in the same order as I did in my last account, and not knowing then the *full* amount of damage done, I wrote as follows:—

> "Twelve miles south of Aldeburgh, at the mouth of the river Alde, a slight sea-wall of mud and wooden 'shies' alone prevents the heavy seas experienced there from overflowing an immense tract of land, by Hollesley. Whether the landlords who own these marshes are prepared to spend a fortune in substantial *stone* dykes remains to be seen; a few more years and they will be too late."

What I anticipated then has actually occurred, only rather sooner than I had expected. The sea-wall below Shingle-street has vanished, and the marshes which lie (like the greater part of the adjacent Essex coast) many feet below sea level are now inundated at every high tide.

At such a time an extraordinary sight is obtained from some point of vantage near. For that which last year was a tract of richest pasture land now forms a part of a great inland lake, and, when the tide recedes, discloses a vast brown dead waste of rotting weeds and foul mud. This inundation extends for considerably over a square mile to the foot of the villages of Bawdsey, Alderton, and Hollesley. Nothing so far has been done to remedy this sad state of things; indeed, the inhabitants declare nothing is possible.

But there was a rumour when I left Aldeburgh in the second week of September, 1898, that a local magnate had hit on a plan, which may turn out to be an effective line of action. It is too late now to think of re-building the sea-walls, but the idea is to sink several large hulks filled with cement and pebbles at the entrance to the breach, and to let the action of the waves, by heaping up more shingle and debris, do the rest of the work and help to form a natural bank and breakwater. At all events, the experiment seems well worth trying, and we hope the attempt will shortly be made and that it will prove effectual.[1]

Passing on down the coast and taking note only of those encroachments which have proved *permanent*, we come to a halt in Hamford Waters.

In the summer of 1895 I landed on Pewit Island, and though I found the farmhouse deserted, the island was still used as pasturage for cattle and sheep. This year it is absolutely derelict. The island may be said practically to have disappeared, and the walls in many places are level with the saltings; great pools of water and tall rushes occupy a large part of the surface, and the numbers and variety of sea birds to be seen disporting themselves thereon was quite remarkable.

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[1] Up to the present date, Dec. 3rd. 1898, nothing has yet been done.

We may confidently assert that this island is now irretrievably lost. In time, when the proper feed has returned, we may expect to see it filled with birds instead of cattle, and perhaps become again, if protection is afforded, a breeding-place of our precious Essex Black-headed Gulls. Such it originally was, as the name implies.

Opposite to Pewit Island and across a deep and wide channel, part of the mainland has suffered in the same way. This, too, I well remember in 1895 as a very rich level of luxuriant pasturage. An appalling sight now meets the eye. A great tidal current at present flows in and out and over the marshes through a deep fissure in the sea-wall, and the whole expanse is at low water an enormous waste of black rotting mud and weeds.

Here, however, a new agency is at work. It appears that this land, being remote and inaccessible, has been bought quite recently by an Explosive and Gunpowder Company, as a suitable locality for their works. Being a rich corporation, they are now endeavouring to build a dam across the tidal rent in the walls; but whether their exertions will be permanently successful remains to be seen. In the last week of August, 1898, when I visited the spot, they had not yet accomplished the first step of filling in the breach, and thus stemming the immense volume of water, which at every tide surges through by the newly-formed channel.

While here I made the discovery that it was only 30 years ago (apparently just before the slump in agricultural land) that Pewit Island and the adjoining tracts of extensive saltings had been reclaimed. Very few of those reclamations remain now. The sea has resumed its supremacy over nearly all of them, and if it was not for the Explosive Company, it would have been allowed unhindered to devour another great portion which I have just described.

All the other islands and marshes in and around Hamford Waters have suffered in the same way, and the farm on Horsey Island for the time being has been almost ruined. The embankments there, however, and on Skippers or Holmes Island, have by this time been made good again, and only the spoilt crops give evidence of the recent severe floods.

The next spot of desolation, I visited, was the island of Northey in the Blackwater. This was exactly in the same state as the explosives company's land we have just left. Breaches in the sea-wall seem to have taken place simultaneously all round the island, the higher part on which the farm itself stands, with its pretty grassy slopes and tall trees alone escaping. All the low-lying portion was rapidly becoming saltings, when I was there last July; and it was only shortly before my arrival that a gang of navvies had been set to work to refill the gaps, which months of neglect had made considerably wider and deeper. The sister isle of Osey close by escaped a similar devastation, owing to its greater elevation above the sea level.

Passing on, we found that the whole coast of Dengie Hundred (a celebrated cereal country) had been overwhelmed; but here, apparently, the permanent damage was not so great or the landowners more alive to the peril of losing time and the repairs were carried out effectually and at once.

Up the Crouch river, where we had least expected it, we witnessed the most disastrous effects of all. The walls here have an appearance of great strength and are usually faced with stone, but even this did not prevent their being undermined, causing a terrible catastrophe. Just below Fambridge Ferry, the wall gave way and then collapsed, and the sea rushing in has penetrated miles inland, even beyond the confines of the railway, and is only stopped by the higher ground by Snoreham. To the west the inundation reaches in an unbroken sheet of water to Woodham Ferrers station, a distance of several leagues. From the precincts of the tiny Church of North Fambridge one appears to be standing on an island in some big lagoon, and a good idea is given of what this part of Essex must have looked like in ancient days, before the sea walls kept the river within its more modern bounds.[2]

But the serious point of this overflow is that since last November nothing has been done in any way to retrieve the disaster, and even should the salt waters be finally expelled the land will remain absolutely useless for many years to come.

Whilst I am writing, a rumour which lacks corroboration has reached me that at last the matter is to be taken in hand and the works of reclamation begun, but this postponement of twelve months duration, will add enormously to the final labour and cost which now must be expended upon it.

In the Essex Archipelago large tracts of the islands were desolated, some of them entirely submerged, and one of them,

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[2] See further remarks on the effects of the flood at North Fambridge by the Rev. R. F. McLeod and Mr. Kimber in the "Notes" in the present part.—ED.

New England, may be said to be practically destroyed. The solitary farmhouse was so weakened by the waves that it has been dismantled and abandoned, and the work of rescue is being confined to a small portion on the western side of the island. This has to be done to save the oyster layings which are in the adjoining channels and which have been seriously damaged already by the mud, which has been washed off the land and deposited in the creeks.

Exciting tales are told by the islanders of their hairbreadth escapes and ultimate rescue, and how most of them were kept prisoners in the upper stories of their farmhouses.

From New England we take a big jump to Canvey Island, not in this case for the purpose of describing another great destruction, but on the contrary, to record with surprise the fact of its having been spared. Canvey, situated near the mouth of the Thames, has to contend against the first onslaught as it were of any unusual tidal flood in that turbulent estuary, and had the walls last November given way on the sea or eastern side, nothing could have saved the island from having been swept away. Fortunately they remained firm and intact, and withstood the enormous pressure of water which must have been forced against them. Only a small portion by the inner creeks fell in, and this was re-constructed without much difficulty.

It is a wonder that all these curious and half-sunken Essex islands should still be able to hold their own and maintain an existence, though it be a precarious one. Probably, however, they are now again vouchsafed a new lease of life, for such an abnormal tide as happened last year, will, in all likelihood not recur for very many years.

Still the general opinion seems to hold good that these ravaging storms have a tendency to become worse and worse, and to leave their imprints on the coast more extended and to penetrate further inland each time. Certainly the great flood of 1897 will long be remembered on the Essex shores as the most severe and appalling that has taken place within the memory of man.

This, for the present, must conclude my notes. Next year, if all is well, I expect to visit again the same afflicted parts, and I trust I shall be able to send you, then, a better and more hopeful account.

AN ANNUAL CONGRESS OR CONFERENCE OF "EAST ANGLIAN" NATURAL HISTORY SOCIETIES.

> **"We be three counties—not shires; the land of the North folk, the land of the South folk—Angles both, and the land of the East Saxons."**
>
> *Mr. D. Howard, Chairman of the Preliminary Conference.*

ON Saturday, July 23rd, 1898, an important meeting was held at Witham in connection with the Field Meeting in the Black Notley and Stisted districts (see Report of Meeting). It was in the nature of a Preliminary Conference between the scientific (natural history) societies of Norfolk, Suffolk and Essex (grouped as a district which, for convenience, although of course incorrectly, we may term the "East Anglian" District), the object being to promote some scheme of friendly co-operative action among the societies, and with that intention to consider the establishment of an Annual Congress or Conference for the discussion of matters of mutual interest.

Those concerned in such institutions are aware that the subject of federated action between societies in adjacent districts has attracted much attention in late years. The discussions at the Conferences of Delegates of the Corresponding Societies of the British Association have conduced to this end. In the "East Anglian" district the question has been alluded to by the then President of the Norfolk and Norwich Naturalists' Society, Sir Francis Boileau, F.L.S., F.S.A., in his Annual Address in 1897 (*Trans. N. and N. Nat. Soc.*, vol. vi., p. 238); although the Ipswich Scientific Society does not publish, and is consequently not at present on the British Association list, the matter has been favourably discussed by their Committee, while the Essex Field Club has brought forward the question on several occasions, and has published papers relating to it, including Prof. Boulger's article on "The Federation Ideal for Natural History Societies, with special reference to the Eastern Counties" (ESSEX NATURALIST, vol. x., pp. 51-55).

In response to the programme issued under the authority of the three societies, a large party assembled at the "Spread Eagle" Hotel at about 11 o'clock. The contingent from the

Ipswich Scientific Society included the President (Dr. G. Vincent), and the Excursion Secretary (Mr. H. Miller), with many members of the Committee. Owing to the distance Norfolk was not very largely represented, but Mr. T. Southwell, F.Z.S., and Mr. Sherrin, F.Z.S., were present, and might in themselves be regarded as an influential deputation from the northermost of the three counties. The Essex Field Club was, of course, well to the fore, many of our most active members being present.

The President, Mr. David Howard, took the chair, and called upon Mr. W. Cole to open the discussion by reading the following paper :—

A SUGGESTION FOR THE ESTABLISHMENT OF AN ANNUAL CONGRESS OF THE SCIENTIFIC (NATURAL HISTORY) SOCIETIES OF "EAST ANGLIA."

By WILLIAM COLE, F.L.S., F.E.S. (*Hon. Sec. E.F.C.*).

Very many of our local scientific societies do admirable work, and work of a kind that probably would not be done at all did these societies not exist. The accurate mapping of the limits of distribution of the members of the British Fauna and Flora which has made such progress in recent years, is very largely due to local societies, and many geological facts of importance gathered from the study of sections in pits and excavations which may remain exposed for a very short time have been preserved in the journals and other publications of these bodies. Their educational and social value is also undoubtedly great.

But friends of the movement have long observed that the efforts of local societies and their members have not borne the fruit to which the enthusiasm manifested would entitle them. There is in too many cases a plentiful lack of method in the pursuits of the members, and a want of continuity in the publication of results, that diminish the value of the papers issued considered as permanent records of the biological or geological studies carried on in the several districts.

To remedy this state of things many suggestions have been put forward, and latterly the Scientific Societies Committee of the British Association have taken up the question. The Committee endeavoured to learn the views of local societies with regard to greater unity and comprehensiveness of work, but somewhat unfortunately, I venture to think, "federation" was put as a fore-word in the communications sent to the societies, and this appears to have alarmed many of them. The idea of "federation" is objected to in some quarters from the not unreasonable fear that this would tend to loss of individuality and possibly diminish the local enthusiasm of the members. The advocates of "federation" have paid too little regard to the varying constitutions and local surroundings of such bodies. Where in a somewhat limited district there exist a number of small societies, some scheme of federation would probably work well; but in the case of large county societies I do not think that any very rigid system of federation touching the business details of each society would do good, and it might very easily do great harm.

I, personally, am an advocate for the encouragement of two large and flourishing societies in *each county* in the kingdom—a scientific (natural history) society and an archæological society. The archæological society should be quite distinct from the natural history one, or the publication of family and parish records will quickly swamp natural history work and papers, a disastrous result only too manifest in the journals of some of the combined archæological and natural history societies.

The "County" is a very ancient division in the kingdom; often somewhat natural in its confines and river-systems, and by reason of the legislation of late years it is likely again to become of great political and social importance. For these reasons, I think that it is the best area for the work of a local society. I do not agree with the view advocated by some, that there should be several natural history societies in each county. This would be copying the error of some of our County Councils in the distribution of the technical instruction funds—giving small doles to each parish, and thus often setting up practically independent instructional organisations, lacking both knowledge and breadth of view, and thereby retarding rather than aiding the cause of true education. I submit that the multiplication of small societies is an evil which we should endeavour to minimise rather than encourage. If it is necessary to hold more widely-spread and frequent meetings in a county than can be managed easily by the main body, surely it would be better to establish Parish-sections or Committees, rather than to weaken the county institution by division of interests, which is almost always caused by the action (or rather inaction) of small societies. Any results obtained, or observations made, should be printed in one county scientific publication, if, indeed, several contiguous countries should not join in the establishment of a really good and comprehensive local journal.

At the present time very few natural history and archæological county societies are adequately supported by residents in the several counties. Surely it is not too much to ask in the "East Anglian" counties (for example) that each society should receive the support of 500 or 600 members. A county society should have an income of at least £300 a year. We have had many suggestions for work put forward for the guidance of local societies during the past 15 years, but the authors of the schemes in too many cases forget that to carry on steady and continuous work of the kind recommended, not only is scientific enthusiasm and devotion necessary, but a considerable annual income is also required. My own observations lead me to think that most natural history societies suffer rather from a lack of the money needed for carrying on investigations which they know to be necessary than from ignorance of what lines of work to take up in their respective districts.

The practical question arises—Can anything be done to improve the position of our East Anglian societies? In the foregoing remarks I have simply stated my doubts as to the practicability or advisability of any system of real business federation; I by no means wish to discourage co-operative work by neighbouring societies. On the contrary, I most strongly support such action. As a means to an end, I beg to put forward a proposal that an Annual Conference or Congress of our East Anglian societies should be established on some such plan as the following:—

> That the members of the three societies should meet together annually in one or other, in succession, of the counties of Essex, Suffolk and Norfolk. The meeting should be carefully organised, and made as attractive as possible. It should be a two-day meeting (at least)—*i.e.*, the members should assemble on the morning of one day for the reading of papers and discussion of plans of work: a general meeting or conversazione should be held in the evening; and on the second day excursions should be arranged to localities of interest in the neighbourhood, and, if possible, dredging and other natural history work undertaken.

There is nothing novel in the suggestions thus put forward; some such plan is adopted by many scientific and archæological societies from the British Association downwards; but it would be quite a new departure in our section of the kingdom, and one, I venture to think, of very considerable permanent value, not only to the societies, but also to the cause of nature-study in our midst.

We should be obliged to arrange for the reading of papers and the delivery of addresses or lectures, and special efforts should be made to obtain interesting *local exhibits.* All these things will be useful in order to induce members and visitors to attend the meetings, and to attract popular interest. But the great value of the Congress would be from opportunities afforded to the active members of the societies of meeting together and discussing methods. There are many lines of investigation and work capable of being carried on by the three societies in co-operation, which might be too difficult or costly to be undertaken by any one society. For instance:—

Systematic dredging operations to ascertain the extent of the fauna and flora of our estuaries and sea.

The establishment of temporary or permanent marine or inland biological stations.

Systematic observation of, and records of, the erosion of the coast-line of the East Anglian counties.

The establishment of one or more seismographical stations for the observation of earth-tremors.

The exploration of pre-historic remains, especially those in danger of destruction.

The systematic collecting of special groups of our fauna and flora, to to complete lists at present in existence or to aid in the compilation of new ones

The proposal and encouragement of restrictions on the wilful destruction of our native fauna and flora, and the desecration of places of natural beauty and of buildings or remains of historical or scientific interest.

Very many other subjects of minor importance could readily be suggested.

To carry on systematic investigations such as the above, considerable funds will be needed, and assuredly the best way to obtain such funds is by an increase in the number of members subscribing to the co-operating societies. A pertinent object of such conferences would be to consider this question, and by putting the requirements and claims of such enquiries before the public to induce the residents in each county to support their local scientific societies. There is also the very important question of easy and cheap travelling to and from meeting-places. It would not be considered impertinent if bodies of naturalists asked the railway companies to put them on at least the same footing as bodies of anglers, golfers and yachtsmen.

Norfolk and Suffolk have long had museums, and now Essex is in a fair way of obtaining a truly local museum. The mutual exchange of specimens is one that might well form an object to be attained by such united action as that I advocate, and another is systematic collecting for the benefit of our museums. It has been well remarked in one of our leading scientific journals that if half the money which is sometimes spent by the authorities of local museums in the purchase of old collections, often of more than doubtful value, were used in obtaining the services of a skilful collector, series of specimens of real scientific and educational importance would be obtained; and the public interest in and success of museums would be much enhanced. From the co-operative action of our societies such collecting could be carried on without much difficulty, and by the division of the specimens at the end of each season, authentic series could be secured at a comparatively small cost.

Finally, we have the highly important but confessedly difficult question of *publications*. I should myself much rejoice to see an "East Anglian" natural history periodical, carried on by some arrangement with the societies in the three counties. The district lends itself to such a mode of illustration. It is impossible to separate the marine fauna of Essex, Suffolk and Norfolk. Our birds and mammals have very much in common, and formations like the Crags and the London Clay can hardly be considered as belonging to one county more than another. To know that the observations made in this exceedingly interesting district were to be found registered in ONE JOURNAL, would certainly be a gain to the local natural history literature of England. One can foresee many difficulties in the way of the establishment of such a a periodical, but they ought not to be insurmountable. A scheme could easily be suggested—the real difficulties would lie in retaining the reasonable control of the journal by each society, and at the same time securing broadness of treatment, the exclusion of merely trivial matter, and scientific accuracy and method. An "East Anglian Quarterly Journal of Natural History" is a consummation to be hoped for rather than confidently expected for some time to come.

Mr. Cole concluded by moving :—

> "That in the opinion of the representatives of the three societies here assembled the establishment of an Annual Congress or Conference is much to be desired, and it is recommended that steps be at once taken to form a Committee of the societies to promote such a Congress in 1899."

Professor R. Meldola, F.R.S. (*Vice-President, E.F.C.*), as Chairman of the Corresponding Societies' Committee of the British Association, from which the suggestion of federation emanated, agreed with most of Mr. Cole's remarks, and strongly favoured co-operation among Societies. There were various degrees of federation, which did not mean that any society should wipe itself out, but simply that there should be co-operation in some form, to be determined by the societies themselves, and by the character of their districts. As to the question of federation between the Societies of the Eastern Counties, he hoped something would be done as the result of the present meeting. He begged leave to second the resolution.

Mr. T. Southwell, F.Z.S. (*Norfolk and Norwich Society*) speaking in support, apologized for the absence of the President and Secretary of the Norfolk and Norwich Naturalists' Society. The subject of federation had, he observed, always been near to his heart, because so much was lost which might be saved by federation, certainly so far as publication was concerned at least. Any movement to keep together the records of the three counties of Norfolk, Suffolk, and Essex must be a move in the right direction. He concluded by remarking that Ipswich would be a capital centre for the first annual congress.

Dr. Vincent (*President, Ipswich Society*) considered that the papers read before the Joint Congress, and the discussion arising thereon, would be a very valuable result of the proposed federation; as much so, possibly, as joint publication. He supported the motion.

Mr. H. Miller (*Ipswich*) agreed with the resolution, and thought that the congress should be movable. The difficulties of transit would be largely overcome if it was a two days' meeting.

Mr. W. Whitaker, F.R.S. (*Essex*), said that he had lived and worked in the three counties, and was himself an example of federation. He would not discourage small organizations such as microscopical societies; in his opinion the special uses of federation indeed would be to foster the small societies, and that would help the larger ones also.

Professor Boulger, F.L.S. (*Vice-President, E.F.C.*). strongly supported the resolution. As also did Mr. J. C. Shenstone, Mr. E. A. Fitch, F.L.S. (*Vice-President, E.F.C.*)

The Chairman summed up the discussion, and made some interesting observations on the importance of individual work, and the encouragement which co-operation would afford to such students. He cordially supported the idea set forth in the resolution.

The Resolution was *carried unanimously*, and it was left to the committees of the three societies to formulate some plan of work on the lines laid down for the first Conference in 1899.

The subject attracted considerable notice by the press. Amongst others, the London *Standard* had an admirable "leader" in its issue on the morning of the meeting. The writer in the *Standard* strongly supported the movement, and especially the establishment of a Zoological Station. In the course of his remarks he commented on the work done by local societies as—

> "neither small in amount nor unimportant in character. This has been ungrudgingly recognized again and again by many eminent scientific men—notably by Huxley, who in his Presidential Address to the Quekett Micro-

scopical Club, said that some of the papers which he had listened to there had made him compare himself to a recruiting sergeant, and inspired him with a feeling that he should much like to give the shilling, and, putting his hands upon the readers, to say, 'Your business is in the army of Science.' But, however good the work of individuals and of local Societies might be, the result of much of it has been lost, owing to want of organization and lack of united effort between kindred bodies. There was on the other hand, the danger of labouring in fields already well worked; and, on the other, that new facts or important conclusions might be buried in the journals of comparatively unimportant societies."

After referring to the excellent work of the Norfolk and Norwich Society, the writer continued—

"In the task of bird-protection the other two counties are honourably associated—Suffolk, of course, the more closely, from its position. Essex has also done good work, and few people are strangers to the increase of bird-life—indeed, of wild life in general—in Epping Forest. The Museums of Ipswich and Colchester, though they cannot compare with that at Norwich, are not to be spoken of slightingly, while that of the Essex Field Club at Chingford has received praise from Sir William Flower.

"No one can say what will be the result of the contemplated federation [the writer is alluding to the meeting now under consideration], supposing that object to be effected. It is to be hoped, however, that it will be something practical; and not a few naturalists would be prepossessed in favour of a zoological station. Proposals for such an institution, already laid before the Norwich Society, have been favourably spoken of in these columns; and joint action with respect to this project might have important results not only from a scientific, but from an economic point of view. * * * * * * *

"District meetings would be a distinct gain, as would a single publication for recording the work done by the members; but the establishment of a permanent zoological station would give better practical results. Not only would such an institution be of incalculable service to the fishing population of East Anglia, but it would also afford opportunities for the scientific investigation of many vexed questions in regard to the life of aquatic organisms, fresh-water and marine. Even if no result so definite and immediate should accrue from the present movement, there is no doubt that it is in itself a good thing, and good must follow therefrom. There will be concentration in place of waste of energy: investigation will be directed into right channels, and the help of trained specialists will be at the service of enthusiastic but untrained workers. Therefore every such federation is to be welcomed as a step forward in the path of the organization of voluntary scientific work. Example is more potent than precept; and it should not be long before the United Kingdom is parcelled out into groups, each represented by a federation of all its Scientific Societies."

In the *Speaker* of July 30th a spirited and convincing article on the meeting at Witham on the previous Saturday was given, under the title of "A New 'East Anglia.'" The article most strongly supported the proposal, and particular stress was laid on two points in the scheme—the ultimate establishment of a comprehensive natural history journal for the three counties, and the formation of a zoological station. The writer said:—

> "Another question raised was that of joint and scientific records. This is admittedly difficult; but difficulties are made to be overcome, and the advantage of one "East Anglian" Natural History journal for the three counties would be a decided gain in the direction of reducing the number of scientific publications."

The writer commented on the value of a permanent biological station for the district, and suggested that this should be one of the principal aims of the proposed Congress. Alluding to the visit to Ray's birth-place later in the day, and to the words of this "father of modern zoology" (as he was called by Professor Ray Lankester), not long before his death—"I must *aliis lampada tradere*"-the article concludes thus:—"The members of the three societies will best honour the memory of Ray by 'passing on the lamp.' There can be no better way of doing this than by making the proposed union of the three counties an accomplished fact, and so constituting a New East Anglia. *Floreat!*"

THE ESSEX FIELD CLUB.

MEETING IN EPPING FOREST (NORTHERN PORTION) & 178TH ORDINARY MEETING.

SATURDAY, MAY 14TH, 1898.

IN the early spring the weather had proved so extremely uncertain that it was deemed safer to defer the usual spring forest ramble until May. On this date the members assembled at Theydon Bois station at about three o'clock, and a ramble was taken in some of the finest portions of the Forest, the route being over Piercing Hill, into Epping Thicks, to Ambresbury Banks, and then to Dullsmead Slade, &c. The special object of the meeting was to gather specimens of the forest trees and shrubs, for illustration of Mr. Elliott's paper in the evening. Many noteworthy specimens were pointed out, special interest being taken in the spread of the aspen and in the forms of the birch.

At about six o'clock tea was taken at the "Wake Arms," and afterwards an ORDINARY MEETING (the 178th) was held, Mr. D. Howard, President, in the chair.

Mr. Percy Clark, B.A., was elected a member of the Club.

Mr. W. Cole exhibited on behalf of Mr. Gearing an old form of cattle-bell, formed of plates of iron rivetted together. The specimen had been at the

"Wake Arms" for nearly 30 years, and had previously been long in use in the forest. Mr. Gearing had presented the specimen to the Epping Forest Museum. Mr. Cole said that this form of bell was still used on the forest, where the sound was so much more in keeping with the surroundings than the wretched cheap door-bells, which some owners were now attaching to their cattle, and they could, he thought, be heard at a greater distance.

Mr. Gearing also exhibited and presented to the Club an implement made out of a red deer's antler, dug up in March, 1891, at Wormingford, Essex. This specimen is fully described and figured in Mr. Worthington Smith's paper in the last part of the ESSEX NATURALIST (vol. x., pp. 310-12, and further commented on by Mr. Lovett in the present part (*ante* p. 351). A vote of thanks was passed to Mr. Gearing for these interesting specimens.

Mr. F. W. Elliott read a paper on "The Existing Trees and Shrubs of Epping Forest." The paper was illustrated by fresh specimens of very many of the species referred to.

A long discussion on special points in the paper was carried on by the President, Mr. Sewell, Mr. W. Cole, and the Author.

Alluding to the statement made by Mr. Elliott on the destruction wrought on the spindle-tree by a caterpillar belonging to the genus *Hyponomeuta*, Mr. Cole called attention to the remarkable discovery recently made by M. Marchal connected with the reproduction of a parasite (*Encrytus fuscicollis*) found in the larva of the *Hyponomeuta*. A single egg of the parasite deposited in the larva became by a process of budding a series or chain of eggs, which ultimately might produce 50 or even 100 individuals. The discovery was one of the most remarkable entomological observations of late years, and opened up an interesting field for investigation in the life-histories of Hymenopterous parasites.

A cordial vote of thanks was passed to Mr. Elliott for his paper (which will appear in the next part of the E.N.) and the meeting ended

RAMBLE IN EPPING FOREST (SOUTHERN PORTION) AND 179TH ORDINARY MEETING.

SATURDAY, MAY 21ST, 1898.

The spring ramble was continued on this afternoon in portions of the Forest but seldom visited by the Club. The party assembled at Snaresbrook Station, and the route was by the Eagle Pond, through Gilbert's Slade, by the East London Waterworks Reservoirs, through the woodlands by Gilbert's Slade, Rushey Plain to Highams Park, and thence west of Woodford over Whitehall Plain to Queen Elizabeth's Lodge at Chingford.

Our member, Mr. D. J. Scourfield and Mr. Sidwell, brother students of Microzoa, were of the party, and during the ramble halts were made at various ponds, such as the Eagle Pond, Higham Park Lake, Warren Pond, &c., to enable collections of pond-life to be made. A considerable amount of material was obtained, including a fine gathering of the beautiful *Volvox globator* from a little pond in Gilbert's Slade. Mr. Scourfield reports that although among the Entomostraca obtained there were several rather rare species, such as *Macrothrix laticornis*, *Ilyocryptus sordidus*, *Leydigia quadrangularis*, and *Alona affinis*, the general character of the collections of these animals was quite normal for the district and time of year and calls for no special remark. In the Higham Park lake, specimens of *Hydra fusca* and other forms were obtained.

Tea was taken at the Royal Forest Hotel, and afterwards an ORDINARY MEETING (the 179th) was held in the large room in the hotel, the President in the chair.

The Secretary exhibited a specimen of *Crepidula fornicata*, L., which had been presented to the Museum by Dr. Laver. The mollusc had been found living attached, limpet-like, to a stone dredged up from the River Colne. The animal contained a large quantity of ova. The mollusc was a comparatively recent importation from North America, probably brought over attached to oysters. It was now evidently breeding both in the Colne and the Crouch rivers.

Mr. Walter Crouch exhibited a series of specimens of *Crepidula* from Essex waters, ranging from quite small individuals to those of almost mature size, and made some interesting remarks on the same and on Dr. Laver's specimen, which are summarised at page 353 *ante*.

The President said that this was an exceedingly interesting instance of the introduction of a new species which was apparently thriving and bade fair to become naturalized. Professor Meldola remarked that it would be a valuable observation to ascertain whether any changes of form or colour resulted from the change of environment.

The Secretary read a paper by Mr Edward Lovett on the use of wooden fish-hooks made from thorns on the Essex coast, and exhibited drawings of the hooks, and some models made by Mr. H. A. Cole on the same plan. Mr. Lovett's paper was printed in the last part of the E.N. *ante* pp. 300—5.

Mr. Cole said that his attention had been directed to this subject by seeing last year in the Economic Botanical Museum at Kew a card with some white or black-thorn thorns on it, labelled "Thorns used as fish-hooks on the coast of Essex." After some enquiry he found that Mr. Lovett had also noticed this singular custom or survival, and the paper just read was the result of correspondence with him.

Mr. Crouch alluded to the use of bone fish-hooks by the Eskimo and other tribes.

Thanks were voted to Mr. Lovett for his interesting paper.

A LECTURE was then delivered by Dr. H. C. Sorby, F.R.S., on "The Preparation of Marine Animals as Transparent Lantern-slides; illustrated by characteristic forms from the Essex Coast."

The subject was one which had occupied Dr. Sorby's attention for some time, during his cruises off the coast in his yacht, "Glimpse." The preparation of marine animals as lantern-slides, so as to show not only their true general form, but also much of their internal structure, is as much a chemical as a biological problem, and different animals require very different treatment. A series of slides was exhibited by the lantern, prepared from animals taken off the coast of Essex, and the adjoining parts of Suffolk, so as to illustrate the processes, the gradual development of the methods, the great advance recently made, and the advantages of special modes of treatment. A collection of photographs of similar examples was also shown. [An abstract of the lecture, written by Dr. Sorby himself, is printed in the present part, *ante* pp. 346-50.]

Dr. Sorby also exhibited slides of Marine Algæ prepared by like methods, and alluded to the chemical and physical properties of the colouring matter of these plants.

A long discussion ensued, carried on by Mr. Howard, Prof. Meldola, Mr. Crouch, Mr. W. M. Webb, Mr. W. Cole and others, and general admiration was expressed at the beauty and success of Dr. Sorby's preparations. The comparative value of various methods and media for the preparation of these animals was much debated. Dr. Sorby said that his processes were as yet only in the experimental stage, and he hoped to make many improvements.

Dr. Sorby was cordially thanked for his lecture, and the remainder of the evening was spent in examining the various specimens exhibited.

NOTES—ORIGINAL AND SELECTED.

ZOOLOGY.

AVES.

Wood-Sandpiper at Paglesham.—I saw to-day (September 15th, 1898) in Mr. Pettitt's (our local bird-stuffer) shop, a nice specimen of the Wood-Sandpiper (*Totanus glareola*). It was shot a few days ago at Paglesham. This bird has been taken in Essex on a few occasions (see Christy's *Birds of Essex*, p. 252), but still it is, I think, of sufficient rarity to to make its re-occurrence worth recording.—Dr. H. Laver, F.L.S., Colchester.

MOLLUSCA.

Large Cuttle-fish (*Sepia*) off the Essex Coast.—The following are the dimensions of a cuttle-fish (*Sepia officinalis*, Lam.), which was brought into the Marine Biological Station at Brightlingsea, when the writer had charge of it in the summer: Length, 13½ inches; breadth, 8 inches; length of each of the two large "arms," 15 inches.—W. M. W.

This may be compared with Mr. Crouch's fine Squid (*Loligo forbesii*) 14¾ inches from the River Crouch; see E.N., vol. vi., p. 87.

INSECTA.

Sirex gigas, L., near Brightlingsea and Colchester.—To the record of *Sirex juvencus* at Brentwood (E. N., vol. x., p. 189) may be added that of *S. gigas* at Brightlingsea last summer. Mr. Harwood, jun., told the writer that both the species breed in the neighbourhood of Colchester, and showed him the larvæ of the first-named and rarer species.—W. M. Webb.

MYRIOPODA.

Occurrence at Colchester of a Centipede, (*Scutigera coleoptrata*, *L*), new to England.—A specimen of this myriopod has recently been recorded from Essex in the "Daily Mail" of October 13th. "It is a form which as a rule confines itself to warmer climates, flourishing on the borders of the Mediterranean, and its presence here was aptly discovered at the close of the phenomenally hot weather of last month. The creature is a centipede, called popularly a 'hundred legs,' or north of the Tweed, with more attention to detail, a "forty-footed Jenny," and it was captured when sunning itself upon a window-ledge in the ancient borough of Colchester. In fact, *Scutigera coleoptrata*, *L.* (Family Scutigeridæ, Gerv.) is the most domestic of the centipedes, and in its native places is to be found about houses as well as under logs and stones.

Specimens have from time to time been collected in the Channel Islands, but the only previous record for the British Isles proper was of a colony which, probably introduced among quantities of rags, established itself in a paper-mill at Aberdeen, and throve amazingly, making a home between the ceilings and the floors.

No theory as to the appearance of the specimen in Colchester has as yet been propounded."

The specimen was taken as a "caterpillar" to a local entomologist (Mr. Harwood), who has since put it into my hands to add to the material which I have been collecting for some years with a view of writing an account of the Essex Myriopods. From the popular account of the discovery in the paper quoted, the following remarks may be taken:—

"The creature in question often darts out to seize the insects it preys upon in the open, and with its relatives must be of considerable service to man. It is unlike the millipedes, or false wire-worms, which are vegetarians, and destroyed whole crops of strawberries in Essex last summer.

"From a scientific point of view, the centipedes are much more nearly related to the true six-legged insects than they are to the forms last mentioned, and *Scutigera*, which is the only one with compound facetted eyes, is perhaps the most insect-like. Its antennæ are equal in length to its body, and its legs, though long anteriorly, get longer as they approach the hinder end of the body, even more markedly than on the common brown form of our gardens. The latter can boast of seventeen pairs, while our visitor rejoices in but nine, though he can make better use of them, running with great rapidity."

I may add that I should always be glad to receive specimens of myriopods and would [illegible] for identification.—WILFRED MARK WEBB, F.L.S., 2, The Broadway, Hammersmith.

ARACHNIDA.

"Aggressive Resemblance" in a Spider.—When making a [illegible] excursion with the boys of the Earls Colne Grammar School, [illegible] specimen of a white spider (*Misumena vatia*, Clck. [illegible] on the flower of a wild rose, and so well did the creature harmonise with its surroundings that it would have escaped notice but for the [illegible] which it was eating, the presence of which in the [illegible] excited curiosity and more detailed examination. The writer [illegible] striking example of aggressive resemblance, either [illegible] Rev. O. Pickard-Cambridge says in a letter that [illegible] on the same day several examples were [illegible] the resemblance, though doubtless of use to the [illegible], was not so remarkable. The male is [illegible] the female both in appearance and [illegible] other sex, unfortunately escaped before it [illegible] F.L.S.

[Mr. Pickard-Cambridge has given, in his valuable monograph, *The Spiders of Dorset*, the following remarks which bear out Mr. Webb's observations:—"This is a common spider in Dorsetshire (and indeed in most other parts of England). It may be found on various plants and flowers, in which it lies concealed both by the petals and other parts, as well as very often by its own similarity to them in colour. I have found the female very partial to the blooms of the great Mullein (*Verbascum thapsus*) and have more than once seen it kill and catch a bee, which had come to suck the honey from the flower. On another occasion I observed one, hidden among the petals of a rose, catch a small copper butterfly (*Chrysophanus phlæas*), which it quickly overpowered and killed. The bloom of the furze is also a favourite resort of the *Misumena vatia*. The males are generally wanderers from plant to plant, and from flower to flower, while the female remains for a long time in one place." Ed.]

BOTANY.

Saponaria vaccaria, L. at Braintree.—This plant is mentioned in Hooker as "a casual in cornfields," other botanists do not seem to notice it as a British wild-flower. It has been found on the banks of the railway lines near Braintree for two summers, one specimen in 1897 and three in 1898. From the growth and habit of the plant (the flower is pink with an inflated calyx with five projections, the plant having smooth glaucous foliage and stems) I took it for a Catchfly, and was for some time completely baffled in my attempts to discover its name. There is not much chance for this pretty wild flower to become naturalized in the neighbourhood, as the sandy gravel of the railway lines is sedulously weeded every summer by servants of the Company, just before the plant has ripened its seed. A potted specimen has produced plenty of seed, from which I hope to get plants next year. (Miss) MAY CUNNINGTON, Braintree. [We hear from Mr. Shenstone that *S. vaccaria* has also appeared at B[illegible]ford. It has appeared on several occasions in Hertfordshire in a sporadic manner. One of the most remarkable instances is that recorded by Mr. R. G. Andrews in [illegible] for 18[illegible]. In 1873 parts of the bed of the Lea were dredged, and the muddy gravel, deposited on the riverside, produced among other plants *S. vaccaria*, but it disappeared in the next year. Ed.]

Villarsia (Limnanthemum) nymphæoides, Vent. in Epping Forest. I have found the "Fringed Water Lily" (*Villarsia nymphæoides*) in tolerable plenty in a pond in the Forest this summer. It is mentioned by Warner in *Plantæ Woodfordienses* as occurring in the river Roding, but I have not yet discovered the plant in that stream. S. ARTHUR SEWELL, F.R.H.S., Buckhurst Hill.

[Mr. Sewell's is a very [illegible] of this plant. Warner's reference to it is as follows: [illegible] in rivers and large ditches. Found in the River Rhodon, almost opposite [illegible] road to Woodford Bridge, near the [illegible] H[illegible] Sir Edward Walpole's [illegible] Near [illegible], Henry Doubleday [illegible] first noticed by Mr. [illegible] near Sunbury [illegible] London, [illegible] H[illegible] [illegible] detail, a "forty-footed Jenny," and it was captured when sunning itself upon a window-ledge in the ancient borough of Colchester. In fact, *Scutigera* [illegible] *L.* (family Scutigerida, Gerv.) is the most domestic of the centipedes, and in its native places is to be found about houses as well as under logs and stones.

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Villarsia (Limnanthemum) nymphæoides, Vent. in Epping Forest.—I have found the "Fringed Water Lily" (*Limnanthemum nymphæoides*) in tolerable plenty in a pond in the Forest this summer. It is mentioned by Warner in *Plantæ Woodfordienses* as occurring in the river Roding, but I have not yet discovered the plant in that river.—S. ATKINS SEWELL, F.R.H.S., Buckhurst Hill.

[Mr Sewell's is a very interesting re-discovery of this plant. Warner's reference to it is as follows: "In rivers and large ditches. Found in the River Rhodon almost opposite [illegible] the road to Woodford Bridge, near the [illegible] House, Sir Edward Walpole's [illegible] Henry Doubleday [illegible] noticed the Marsh [illegible] near Sunbury [illegible] London, at Hackney and Hampton [illegible] it is an alien in that county. Unfortunately, it is one of those species frequently artifically planted by unthinking botanists, and hence many of the records in botanical lists are of doubtful value —Ed.]

Ophrys apifera near Brentwood, and Lathryus nissolia in Essex.—During a ramble of the Brentwood Field Club on July 9th, 1898, a new locality near Herongate for the Bee-orchis *Ophrys apifera* Huds. was discovered, which is probably the nearest habitat to London at present known for this handsome plant. Several specimens were found amongst the grass by the members during the afternoon.

This opportunity might be taken of noting that the Grass Vetchling (*Lathyrus nissolia*) recently mentioned in the Essex Naturalist (*ante* p. 336) occurs at Chelmsford in the lanes and on the railway banks, and can also be collected at Great Warley, near Brentwood.—W. M Webb, F.L.S.

MISCELLANEA.

The Ancient Camp at Uphall, near Barking.—On two or three recent occasions we have called attention to the fact that this camp was in imminent danger of destruction owing to the fact that the site, as well as the other land at Uphall (whence came Sir Antonio Brady's wonderful collection of Pleistocene Mammalia) was to be sold by auction (*ante* pp. 143 and 176). We wrote to several societies likely to be interested in the preservation of such antiquities, but the enormously increased value of land in the neighbourhood precluded any attempts being made by purchase on the part of scientific or archæological societies (notoriously poor as they are!) to wrest the site from the grip of the speculative builder. The lot including the earthworks came to the hammer on July 1st, and was sold, but we have our President's (Mr. Howard's) word for it (given at the Club meeting at the "Ferry Boat," Walthamstow, on July 2nd) that he did not think the present owners of the camp would disturb it, inasmuch as he was one of them! This will be most gratifying news to all interested in local archæology; and now may we venture to hope that some attempt will be made to ascertain the period of the camp—a vexed question for more than three centuries? The best account of the earthwork, and indeed, the only complete one extant, is that by Mr. Crouch in the E.N. (vol. vii, pp. 131-138), but absolutely no reliable evidence exists to show that the camp is British, Roman, or Danish.[1] One of the latest writers on it is Mr F. T. Norris, who, in a communication to the *Gentleman's Magazine* in October, 1888, advanced considerations for regarding it as a Danish fort. An important piece of evidence, Mr. Norris suggests, is that Barking was originally called Beddenham, and only after the (East) Monastery was burnt by Guthran and his Danes in 871 was it called Barking, a Danish place name connoting *ang* or field of the *borg* or fort which they had built. "Barking or Beddenham Monastery, of which one of the gates and possibly part of the church still remain, is remarkable for being the Monasterium on the East side of London which gave rise to the title of West Monasterium for that of Westminster. The foundation of both (*circa* 670) is due to the same East Saxon Kings, as the unique extant charter, &c., show." On this our Vice-President, Mr. T. V. Holmes, remarks, "Whatever Barking may have been called originally, the camp is well to the north of the town, and the site of the latter is certainly a more eligible place from the Roman and indeed of any point of view—as that of a British fishing village for instance. But the people of an ancient fishing village might well have a camp of refuge from pirates a little higher up the Roding. Pirates ascending that stream and finding valuables removed would hesitate to go up higher, and withdraw. I do not see what use a camp up the Roding could be to the Danes. It is not like Pitsea or Shoeburyness, a situation for their fleet; and though the Danes went up the Lea once, King Alfred blocked up the passage, and they had to cross the country to the Severn. Even the Lea is far deeper and broader than the Roding, up which a fleet would hardly dare to ascend as far as Uphall Camp." But in the absence of scientific ordeal by pick and shovel, speculations as to the makers of such earthworks are but vain imaginings. We can but plead that a distinct service would be rendered to true archæological science by a careful exploration of a section or two of the ramparts to settle a puzzle of generations of local antiquaries since Camden—and no one need fear any permanent disfigurement. The excavated soil could be easily replaced, and such "auncient ruynes" are rendered vastly more interesting and valuable when their true histories are known.—Ed. [Mr. Walter Crouch has some further notes on the camp in the recent part of the British Archæological Association's *Journal* together with a sketch plan of the earthworks. We are sorry to see in the report of the Council of the "National Trust" that neither that excellent society nor the Society of Antiquaries can see their way to acceeding to the proposal of the Essex Field Club to join in an attempt to settle the question by a systematic exploration. Mr. Howard says that he would not be adverse to such an exploration conducted on scientific principles.—Ed.]

---

[1] We understand that General Pitt-Rivers (the Inspector-General of Ancient Monuments) considers the camp to be of Danish origin, and that he strongly recommends some efforts being made to explore the earthworks.

Disastrous Effects of the High Tide of November, 1897, at North Fambridge.—The Rev. R. F. McLeod, Rector of North Fambridge, has recently called attention in the *Times* to the deplorable condition of that parish, through the bursting of the sea-walls by the high tide of November, 1897. Four great breaches exist in the bank, one of which is about 150 feet wide. Through these the tide ebbs and flows daily, converting some 500 acres of land into huge salt lakes, whereon a fleet of yachts could manœuvre. In a private letter with which Mr. McLeod has favoured us, he says (under date, October 27th, 1898); "It is very difficult to tell you the exact acreage flooded. The statement in my letter to the *Times* referred only to the acreage submerged in *this parish*, viz., about 500. The land is flooded for about three miles in length altogether, with an average width of about three-fourths of a mile—*i.e.*, from near Clements Green Creek to Hyde Marsh. Both these points are outside this parish. In my parish there is a huge breach in Blue House Farm river bank, and three in Grooms Farm. Blue House is on the E. and Grooms on the W. side of the parish, and the waters from both sides meet. Several farms are flooded more or less—some have as much as half the land under water. The land is now covered with sea-weed, and marsh samphire, or glass-wort, is growing abundantly everywhere. The gulls and other sea-birds are making the fields their feeding grounds. Part of the highway near the river is flooded, so that the near bank at the Ferry cannot be reached at high-tide, except by boat. Several cottages are flooded at spring-tides and the salt water has got into the village well several times." Mr. J. H. G. Kimber, of Bridgemarsh, having written that the Rev. R. McLeod had understated the case, and that 5,000 acres would be a more correct estimate, we communicated with him on the subject. In his reply (dated October 16th) Mr. Kimber writes:—In my estimation of the extent of floods in this district I calculated all that land from which the water has during this month somewhat receded, and which lies on both sides of the railway, and within a ten miles radius of Fambridge. I think that you will find I am considerably below the mark. Many people put the figures far above mine. I note that in your letter you refer to the land by the words 'gone to sea.' Accepting that term as synonymous with 'almost irrecoverable land,' probably the Rev. Mr. McLeod is correct." It will be noticed that the two estimates are by no means discordant; Mr. McLeod's 500 acres referred to land in North Fambridge parish alone. Mr. Kimber argues very forcibly that it is the duty of the County Council or the State to repair the sea-walls and reclaim the land, but this is a very difficult legal and political question, quite outside our province.- ED.]

The Countess of Warwick's Village Science School.—Those who were present at the delightful meeting of the Club at Easton Lodge, on July 21st, 1897, will recollect the visit made to the School at Bigods, near Dunmow (*ante* p. 185), which was then in process of formation. Since that date the School has been completely organised by Lady Warwick, acting on the advice of Prof. Medola, and chemical and physical laboratories well arranged for practical elementary instruction have been added thereto. Mr. E. E. Hennesey, B.A., B.Sc., has been appointed Principal and her ladyship intends the institution to be not only highly efficient for secondary education, but also a "School of Science" in accordance with the curriculum of the Science and Art Department. A small sum of £50 per annum has been granted in aid by the County Council. The School was inaugurated on July 29th last, at a meeting held at Bigods, which was attended by a numerous and distinguished company. The chair was taken by the Countess, supported by the Earl of Warwick. Full details of the idea and mode of working the School were given, and Prof. Meldola delivered an address on "Scientific Education in Rural Districts." He protested against the continuance of the system hitherto adopted by most County Technical Instruction Committees—that of endeavouring to teach adults "by sporadic courses of heterogeneous information"—and argued forcibly in favour of a well-considered system of secondary education in rural districts. The object that Lady Warwick had in view, he said, was to stem the tide of townward immigration, and to turn the youth and energy of the coming generation once again towards the country. The address has been published in pamphlet form, and we understand that copies may be had from the Principal. It is an admirable sketch of the ideas on the subject which are now permeating the the minds of all thoughtful educationists. Sir John Gorst wrote thus to Lady Warwick.—"Your School is a most interesting experiment, of which I should have liked to see and hear more personally. I hope it may encourage other County Councils to devote some of the public funds which they administer to the establishment of Central Higher Schools in the rural districts. Technical and scientific education in the rural districts of England is far behind Scotland and Wales, and still further behind most European countries. You are pursuing the right way of raising it, and I heartily wish you success." The progress of Lady Warwick's village school will be watched hopefully by all having the diffusion of sound elementary scientific knowledge in the county at heart, and who may have viewed with some dismay the mistaken and misdirected educational attempts made of late years in some rural districts.—ED.

THE ESSEX NATURALIST

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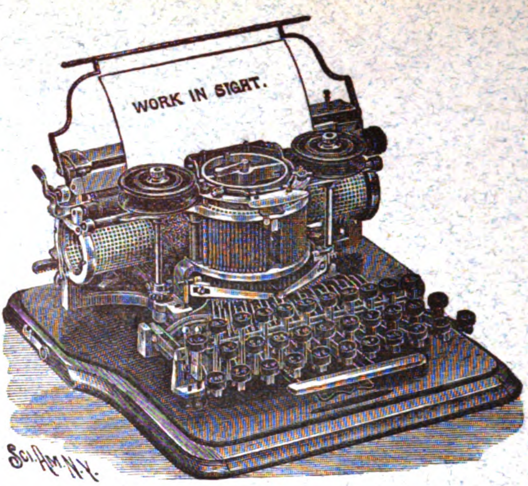
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WILLIAM COLE, F.L.S., F.E.S.,
Honorary Secretary and Curator.

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The authors alone are responsible for the statements and opinions contained in their respective papers.

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"In respect of physical conditions Essex is one of the most favourably situated of the eastern counties of England for the possession of a large local fauna, its inland districts presenting variety of station, while it has a large sea-board, forming an estuary into which discharge several more or less important rivers. Indeed, were it not for the pollution of the Thames, the fish-fauna of the county would be even larger than is at present the case, and would reckon among its constituents the lordly salmon itself. Among other special advantages, from a naturalist's point of view, the county includes Epping Forest, which, under its present excellent administration, forms a sanctuary for wild creatures of many kinds. And, in addition to its natural advantages, Essex is fortunate in possessing a Field Club, which includes in its working roll many naturalists of high capacity. It is to a member of this club that we owe the present contribution to a knowledge of the fauna of the county. . . . . The volume is illustrated with several photogravures, all of which are excellent from an artistic point of view, while several afford interesting glimpses of local scenes. If it be regarded merely as a stepping-stone towards fuller treatment, the work may be welcomed as indicating the recognition of the importance of treatises on our local British faunas."—R. L., *Nature*, July 14th, 1898.

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THE EXISTING TREES AND SHRUBS OF EPPING FOREST.

By F. W. ELLIOTT.

[*Read 14th May, 1898; abridged and revised September, 1898.*]

DURING the early years after the passing of the Epping Forest Act the Conservators established nurseries containing a great variety of trees and shrubs, both British and foreign, which are now beginning to bear fruit. Many seedlings will doubtless spread through the Forest, so that in future years there will be difficulty in deciding whether a particular shrub may not owe its existence to these nurseries. It therefore behoves the Essex Field Club to lose no time in cataloguing the trees and shrubs now occurring in the forest, and I have therefore ventured to make a beginning, in the hope that other members will add to my list.

I have included only those species whose existence I have verified during the last twelve months, and have limited my area to that under the control of the Epping Forest Conservators, exclusive of Wanstead and Higham Parks. I have, however, very little botanical acquaintance with the extreme northern and southern portions of this area.[1]

In Volume VI. of the ESSEX NATURALIST is a list by Mr. J. T. Powell of the rarer flowering plants found within the limits of the forest as defined by the perambulation of Charles I., which included 50,000 acres of land now private.

In Mr. E. N. Buxton's guide-book, *Epping Forest*, is a very complete Flora, which, however, includes plants certainly not to be found in the forest as we know it. Mr. Buxton also devotes a chapter to the trees, but his list is not sufficiently full for our purpose.

I shall say nothing about the Blackberries, the Roses, or the Willows, as I know very little about them. Volumes III. and V. of the ESSEX NATURALIST contain notes of the Epping Forest Rubi by Mr. J. T. Powell; and Professor Boulger has some materials for a list of the Willows.

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[1] In reading this paper, Mr. Elliott's very restricted area must be constantly borne in mind; if my area (E.N., vi., 10) had been adopted several other species might have been included, while many plants noted as rare by Mr. Elliott are fairly common in lanes and fields near the official forest.—W. COLE.

If some botanical member would take up the story of the Roses and prepare a list of the sub-species, a great service would be rendered to the natural history of the forest.

Clematis vitalba, L. *Traveller's Joy.*

In a hedge forming the northern boundary of part of Bury Wood. It was pointed out by Mr. Cole during a meeting held in the neighbourhood on 13th May, 1893. The *Clematis* extends along the hedge for several hundred yards, in some places with branches so thick and tangled as to be self-supporting.

Tilia europæa, L. *Lime-tree*, or *Linden.*

Occurs occasionally on open ground, where it has evidently been planted, and in some of the avenues. I have not met with it in the woods.

T. parvifolia, Ehrh. *Small-leaved Lime.*

Of this species or variety there is an example on Warren Hill, Loughton.

Ilex aquifolium, L. *Holly.*

To a stranger exploring the forest for the first time, its most striking feature would perhaps be the abundance of holly in the dryer quarters. In some places it constitutes almost the entire undergrowth, notably at Woodford and in parts of Lord's Bushes. Probably as the old pollards become replaced by well-grown trees, the holly, in common with other undergrowth, will decrease. There are some fine old specimens scattered about the forest. Perhaps the oldest is a still living stump in Lord's Bushes, which measures six feet in circumference and is surrounded by a small thicket that has sprung up from its roots.

Euonymus europæus, L. *Spindle-tree.*

This interesting shrub, which bears a beautiful rosy four-lobed fruit, is very scarce in the forest. It must generally be looked for in damp places. I have found it here and there in the valley of the Ching, where the thickets are densest, and near Manor Road, Loughton. The best bush, however, that I have met with is not far from High Beach Church. As it usually grows mixed up with thorn bushes, when a clearance is made of the undergrowth and it happens to be in the way, the Spindle-tree goes down with the rest. We have lost several specimens from this cause.

Rhamnus catharticus, L. *Buckthorn.*

Fairly plentiful in the Ching Valley, where it grows at times to a height of nearly 20 feet, and in one case with a stem two feet in girth.

Rhamnus frangula, L. *Berry-bearing Alder.*

I searched for this shrub last spring on the forest at Snaresbrook, where it was recorded by Warner, but without success. However, hearing that Mr. J. T. Powell had noticed it there in recent years, I have tried again this autumn, and find that it still exists in the old position.

Acer campestre, L. *Maple.*

Scattered about the forest, but most plentifully in the Ching Valley. There are some trees of a considerable height in the district north of Connaught Water.

Acer pseudo-platanus, L. *Sycamore.*

Spreading in many places, chiefly near the outskirts, but also in the Ching Valley. I do not remember to have seen a pollard, so that it is probably an introduction of this century. Warner, in his *Plantæ Woodfordienses*, does not mention the occurrence of the tree in the forest.

Genista anglica, L. *Petty Whin*, or *Needle Furze.*

Very plentiful in the open parts. It seems at home on any soil, and I think it is spreading.

Ulex europæus, L. *Furze*, or *Gorse Whin.*

Throughout the forest, but chiefly in dry open places.

Ulex nanus, Forst. *Dwarf Furze.*

I only remember noticing this plant at High Beach and on Leyton Flats, where it was pointed out to me by Mr. W. Cole, who has also seen it at Woodford. It was common in Warner's time, and it is quite likely that it is so now. It appears to vary in habit and in the wing petals, sometimes approaching *U. gallii* in these characters. [I have this autumn (1898) found it abundant in several districts of the forest, where its late flowering habits render it very gay and cheerful in the absence of other plants. The only form hitherto found is the true *nanus*; I have not yet seen *U. gallii* on the forest, although it may exist in the higher northern parts.—W. COLE.]

Cytisus scoparius, Link. *Broom.*

According to Warner, "very common." Twenty years ago, however, it was to be found in very few spots; but now it is spreading fast and covers the sides of many deserted gravel pits. Probably the gipsies were responsible for its former disappearance.

Ononis spinosa, L. *Rest-harrow.*

May be looked for in most places where the needle-furze is found. There is a large quantity behind Paul's Nursery at Loughton.

Prunus spinosa, L. *Blackthorn, Sloe.*

Everywhere, especially in the thickets of the Ching Valley. It seldom fruits in the forest.

Prunus insititia, L. *Bullace.*

In the Ching Valley and in the thicket between Manor Road, Loughton, and the Buckhurst Hill cricket ground. I have not looked for it elsewhere and have never seen the fruit.

Pyrus malus, L. *Crab-apple.*

All over the forest. Old trees are most numerous between Earl's Path and Monk Wood. The "American Blight" aphis *(Schizoneura lanigara)* has invaded our crab trees and seems to be spreading.

Both forms occur, var. *acerba* with drooping fruit, and var. *mitis* with fruit erect; but I have not noticed which is the more plentiful.

Pyrus torminalis, Ehrh. *Wild Service.*

Not very common. I only know two or three dozen instances at present. Probably the largest is a tree growing about one or two hundred yards north-west of the great oak near Connaught Water. It measures five feet three inches in girth and thirty feet or more in height—a very fair size for this species. There are a few pollards in the same district and one in Lord's Bushes, as well as one in the thicket south of Manor Road, Loughton, and some more to the north of Earl's Path. There are also from ten to twenty saplings in Lord's Bushes, one of them having reached the fruiting age. On Warren Hill, Loughton, is a tree which sends up hundreds of suckers from its roots, but, there being no cover for them, all get destroyed.

Pyrus aria, Ehrh. *White Beam.*

One tree in the midst of a thorn bush on Warren Hill, Loughton. I will not venture to name the sub-species. There are many young trees in the nurseries, but not of the same sub-species as this one, which is also too old to have come from that source.

Pyrus aucuparia, Gærtn. *Monntain Ash*, or *Rowan Tree.*

Scattered all about the forest, but, so far as I have noticed, never more than a few inches thick. It is certainly increasing, and there is no doubt that its presence is entirely due to seeds brought by birds from the surrounding gardens.

Cratægus oxyacantha, L. *Hawthorn*, or "*May.*"

With the blackthorn in the damp parts and the holly in the gravelly districts, the hawthorn forms the bulk of the undergrowth. Sub-sp. *oxyacanthoides*, with two styles, is fairly common. I have not noticed any flowers or fruit with three styles, but have not searched very carefully. There is considerable variation in the leaves of this sub-species, but much more in the case of *monogyna*, the one-styled sub-species, which abounds in the forest. One extreme form has a great many thorns and small deeply-cut leaves, with the narrow basal lobes well separated from the rest of the leaf, while another form bears fewer thorns and broad leaves much less lobed. Between these extremes are other forms connecting them. The fruit also varies in size and shape.

Ribes rubrum, L. *Wild Currant.*

I found one small plant early this year in the forest near the 10th mile-stone on the Epping New Road, but it has now disappeared (September, 1898). Possibly it was a garden escape.

Hedera helix, L. *Ivy.*

Everywhere, particularly in moist places. When trailing on the ground its leaves are lobed and of moderate size. Sometimes we find it with slender brittle stem, closely pressed to the trunk of a pollard, and leaves small more deeply divided and delicately marked. In a good soil it climbs high and develops a luxuriant growth of dark green glossy leaves, whose lobes are less marked or disappear altogether, saving only the terminal point.

Cornus sanguinea, L. *Cornel*, *Dogwood.*

Common in the Ching Valley and other moist parts. Its red twigs and (in the autumn) blood-red leaves render this the most conspicuous shrub of the thickets.

Sambucus nigra, L. *Elder.*

Common, particularly in the thickets of the Ching Valley.

Lonicera periclymenum, L. *Woodbine*, *Honeysuckle.*

Throughout the forest, but it seems to be most vigorous and to flower best in the moist parts. Occasionally the honeysuckle bears leaves that are lobed somewhat like those of the oak. There is one cluster in Lord's Bushes where nearly all the leaves are of this form and the character shows year after year. I have not seen it in flower, and it has the usual delicate growth one finds in the honeysuckle on dry soils.

Vaccinium myrtillus, L. *Whortleberry*, *Bilberry.*

Following directions supplied by Mr. J. T. Powell, I have seen this plant growing thickly on a very small area to the east of High Beach.

Erica tetralix, L. *Cross-leaved Heath.*

The only heath I have found. It grows chiefly in the high parts of the forest.

E. cinerea, L. *Bell Heather*, or *Fine-leaved Heath.*

Mr. W. Cole found this on Leyton Flats in 1874, and he has shewn me specimens gathered there this autumn; perhaps the old station mentioned by Warner.

Calluna vulgaris, Salisb. *Ling.*

Throughout the forest, particularly, of course, on light soils.

Ligustrum vulgare, L. *Privet.*

One bush on the bank of the Ching. There are some to be found in the nurseries.

Fraxinus excelsior, L. *Ash.*

There are many fine trees in the Ching Valley, chiefly to the north of Connaught Water, and some young trees exist in Lord's Bushes. It appears to be spreading.

Daphne laureola, L. *Spurge Laurel.*

Scarce. In the Ching Valley and only in the densest thickets. It has suffered through the clearing of the undergrowth.

Viscum album, L. *Mistletoe.*

On the crab-apple. I have never looked for it in the forest on any other tree, and have not seen it south of Debden Slade.

It might be worth while to search the hawthorns. Mistletoe almost always grows from the underside of a branch. Perhaps the seeds are deposited by birds on the top or side of the branch and washed round by the rain. As I have never seen any large bunches in the forest I fear somebody cuts it, mistletoe being a marketable commodity.

Ulmus montana, Sm. *Wych Elm.*

There are fairly large trees on Warren Hill, Loughton, and young trees on the banks of the Ching below Whitehall Road. Probably they have all been planted.

Ulmus campestris, Sm. *Common Elm.*

In the same localities; as well as by the pond on Fairmead and where an old hedge used to run between Fairmead Lodge and the road. There are also some trees near Queen Elizabeth Lodge, and of course plenty in the boundary hedges skirting the forest and in such roadside wastes as Gilwell Lane.

Populus alba, L. *White and Grey Poplars.*

There are some fine trees on Warren Hill and at Leytonstone and nearly opposite "The Warren Wood" public house, Buckhurst Hill, but having not yet met with any female flowers, I cannot be sure of the sub-species. Judging by the leaves alone most of them appear to be *canescens.*

They have no doubt been planted.

Populus tremula, L. *Aspen.*

Probably the only wild poplar we have in the forest. It is increasing fast in the higher parts and in Lord's Bushes. The older specimens seem to acquire some of the characters of *P. canescens*, particularly with regard to the bark and the shape of the leaves.

Populus nigra (Black Poplar), *P. fastigiata* (Lombardy P.), and *P. balsamifera* (Balsam P.). These three trees and, I believe, also *P. deltoides* are met with in many places where they have evidently been planted. With the exception of the Lombardy Poplar, they are extremely unpicturesque. Perhaps *P. balsamifera* takes the palm for ugliness; yet, on account of its rapid growth, it is very commonly grown in the gardens of this neighbourhood. It is a great pity that the Conservators should have chosen poplars for some of the avenues they have seen fit to plant on the open greens. Surely, if avenues are necessary at all, any of our native forest trees would be more beautiful than these.

Quercus robur, L. *Oak.*

Grows everywhere throughout the forest on moist as well as dry ground. It is, however, more plentiful on the heavy clays, because the beech is not there to smother it. The oak is extremely variable, nearly thirty forms having been described as found in Britain. These varieties are generally grouped, very loosely, into three—*pubescens*, *sessiliflora*, and *pedunculata*. I have not yet met with an example of *pubescens* large enough to be called even a sapling, but I have found several small shrubby specimens near Earl's Path, bearing rough hairy leaves—a character not temporary, but lasting throughout the year.

Mr. Buxton states that the oak which abounds in the forest is *sessiliflora*, having acorns without footstalks, and Mr. J. T. Powell, in the ESSEX NATURALIST, Vol. VI., page 7, supports this view. On the other hand, Warner in 1771 described the "Oak Tree with Acorns on short footstalks" (*i.e.*, opposed to long footstalks) as "Found on the Forest between Muncombe and The Bald Faced Stag: not common." My own experience is that acorns on stalks as long or longer than themselves are vastly more numerous than stalkless and short-stalked acorns put together. I do not believe that a single tree could be found bearing *only* stalkless acorns, for the length of fruit stalk, as well as the leaf stalk and the shape of the leaf, vary not only on different trees, but on each individual tree. The shape of the acorn is perhaps the most constant character. I have seen on a tree, whose leaves had long petioles (½ inch), fruit stalks varying from ½ inch to 8 inches, the majority being about 1½ to 2 inches long. While a tree, whose leaves had shorter petioles, shewed fruit stalks varying chiefly from ⅛ inch or less to ½ inch, and, within easy reach, one of 2 inches. Such variations in fruit stalks and leaves are the rule, but I have no hesitation in stating that the great mass of oaks in the forest may be broadly classed under *pedunculata*.

Fagus sylvatica, L. *Beech.*

This, our most beautiful tree, is happily very plentiful on all the high ground, but it does not like cold wet soils such as we find in the bottom of the Ching Valley and the lower part of Lord's Bushes. Throughout the central portion of Epping Forest, where the soil is very mixed, plentiful beeches and old gravel workings generally occur together.

Corylus avellana, L. *Hazel.*

In the hedge I referred to as containing the *Clematis*; also in the thicket south-east of "The Woodman" and in Bush Wood, Wanstead. There are many hazels in the nurseries.

Carpinus betulus, L. *Hornbeam.*

Everywhere, including those damp places shunned by the beech.

Betula alba, L. *Birch.*

On the same soils as the beech in our forest. As, however, its seedlings prosper without cover, while the young beech needs undergrowth for its protection, the birch is fast spreading over open spaces which are equally well suited for the other tree. It will be interesting to notice whether it will serve as nurse to the larger trees and to compare it in this respect with the hawthorn, which sometimes spreads with equal rapidity on the heavy soils (witness—the remarkable thicket to the north of Warren Hill, Loughton).

Of the three forms of *Betula alba*, sub-sp. *verrucosa* is the most graceful, having light pendulous branches and long pointed deeply serrate leaves. It is much less common than sub-sp. *glutinosa*, which has a stiffer habit and denser foliage and a less shapely outline. Sub-sp. *pubescens* when old is of similar appearance to *glutinosa*, of which it is sometimes classed as a variety, but when young it is easily distinguished by the dense velvety down on the twigs and leaves, which gives the whole plant a darker shade. When old, the same character shows to a less extent on the young shoots.

All three forms are to be found in Lord's Bushes; I have not looked for *pubescens* elsewhere, but I have no reason to doubt its existence in other parts. Probably the largest birch tree in the forest is one in Lord's Bushes belonging to this variety and measuring six feet in circumference at three feet from the ground. There is a collection of fine birches near Cook's Folly, shewing very well the beautiful ring markings in the bark. Close to the western side of Ranger's Road is one young birch; I believe it to be the only one at present in this part of the Ching Valley.

Alnus glutinosa, L. *Alder.*

On the banks of the Ching below Whitehall Road. Being well down the stream, it is not likely to spread much in the forest from this centre, nor yet from Highams Park, still lower down, where it also occurs. There is, however, one tree near the head of this valley overhanging a small pool in what was once the grounds of Fairmead Lodge. There are alders in the nurseries, but not near to any water.

Pinus sylvestris, L. *Scotch Fir.*

Planted here and there on ground once alienated from the forest, but now thrown open. It does not flourish and looks thoroughly out of place.

Taxus baccata, L. *Yew.*

The small sapling reported in the ESSEX NATURALIST for May, 1888, died a year or two ago. I have, however, found a much stronger specimen in the Ching Valley, about 150 yards east of the great oak. It is three feet high and two-and-a-half feet across, with a stem as thick as one's finger. Growing from the midst of a small bush, it is not very noticeable in the summer time.

Warner mentions the "Eugh or Yew Tree" as "found between the King's Oak and Epping, on the Forest, near the Fourteen Mile Stone." That would be somewhere near the "Wake Arms."

There is an ill-grown yew tree close to Whitehall Bridge that was once within the grounds of Whitehall, the fence having been put back to round off a corner.

Ruscus aculeatus, L. *Butchers'-broom. Kneeholm,* or *Knee-holly.*

Fairly common in the forest, but seldom bearing fruit, although the male flowers are plentiful. This very interesting plant, our only monocotyledonous shrub, is not likely to become rare, since its roots are very deep, sending up fresh shoots every year, and it lives many years.

In addition to the British Trees and Shrubs and to the Poplars mentioned in the foregoing list, we meet with many individuals of species not proper to this country, some planted in the old days of enclosures, such as Turkey and other Oaks, Horse Chestnuts and Larches, and others that have escaped from neighbouring private grounds. Among the latter may be mentioned the following :—

Berberis aquifolium, a common garden barberry, which has established itself in the forest near the tenth milestone on the Epping New Road.

Amelanchier canadensis, a North American cousin of the pear, found in Lord's Bushes.

Castanea vulgaris, the Sweet Chestnut. The old trees on the green at Wanstead and those near the rhododendrons, in what was once the Oak Hill enclosure, have no doubt been planted, but there are others of various ages near Copt Hall evidently seeded from trees in the park.

These natural introductions are always interesting, but deliberate planting of trees brought from without the forest should be discouraged. If planting is necessary, and I think in some parts it is, everything planted should be taken from the forest. The aim should be merely to assist and accelerate Nature. There are several open spaces that are much larger than necessary, the outer edges of which might be planted with hawthorns, leaving the trees to spread naturally through the cover thus provided. This method would be certainly less objectionable than the one which has been adopted of planting specimen trees at nice regular intervals.

Before closing these notes it may be well to mention a few shrubs not in the foregoing list, but which might be expected to occur in the *present forest area*. Some of them I believe I have seen in past years, but have now lost sight of. Any that are known to exist by other members of the Club should be recorded in the NATURALIST. [All these plants have been recorded for the forest by various observers from Warner's time onward, but Mr. Elliott's desire is, of course, to know whether they *now* exist in the woods under the control of the Conservators.—W. COLE.]

Berberis vulgaris, L. Barberry.
Genista tinctoria, L. Dyer's Green Weed.
Prunus padus, L. Bird Cherry.
Pyrus communis, L. Wild Pear.
Viburnum opulus, L. Guelder Rose.
Myrica gale, L. Sweet-gale, or Bog-myrtle.
Juniperus communis, L. Juniper. This used to occur in Warner's time between Waltham Abbey and Epping. Those who have seen the luxuriant masses of Juniper in Burnham Beeches would be glad to welcome it back to Epping Forest.

A VISIT TO THE BLACK-HEADED GULLS IN ESSEX (1898).

By PERCY CLARK, B.A.

[*Read, December 17th, 1898.*]

THE great inundation by the sea which took place on the Essex coast last winter has not only sadly interfered with the feed of the cattle on the parts that were submerged, but has also apparently deprived a large portion of the bird world of the like means of subsistence.

In the following remarks I will confine myself entirely to the curious case of the Black-headed Gulls *(Larus ridibundus).*

In former days Essex was the great breeding place of these birds. This we know not only from written records, but from the number of the marshy islands along its borders which are called after the Black-headed Gulls' local name of *Puit*, now misleadingly spelt *Pewit* in most county maps.

The enormous stretches of marshes, swamps and saltings which once abounded near the coast and estuaries of the province were infested with every sort of water-loving bird, although the Black-headed Gulls were probably from time immemorial the most numerous. This is shown by the frequency with which the local name of *Cob* is still attached to various places (*c.f.*, Mr. Miller Christy's valuable work, *The Birds of Essex*, E.F.C. *Special Memoirs*, vol. ii., p. 267).

But the wholesale draining of the flats in later times has caused many species entirely to desert their former breeding grounds, and at the present day of sea-birds, the black-headed gulls alone remain to nest there in any numbers.

These gulls, so well known in all the reaches of the Thames, from its mouth to Kew Gardens: the hungry visitors who in winter fly in hundreds along the Victoria and other embankments asking to be fed: the daring invaders of the sacred wild fowl enclosures on the lakes of our London parks; these, within the last few years, have become regular frequenters of the Metropolis, and added, by their presence and confiding demeanour, considerable charm to the bird life which there is only too rare. They have made themselves quite at home on the lake in St. James's Park, where they come in flocks to pick up the scraps left by the tame ducks; and they are to be met with on the whole length of the Thames below Richmond a good six months of the year. (Only recently I saw several flying about Battersea the second week in September.) Their fearless confidence in visiting the smoky and multitudinous city so far inland has, it must be confessed, met with a ready and kindly response. The birds have won a place in the cockneys' heart, and are sure whenever they appear to be welcomed with warmth and even enthusiasm.

It speaks well, too, for the manner in which the London drainage is now disposed of, that the gulls should penetrate the river so far, for it means, I think, that the smaller fry and fish are appearing again in increasing quantities in waters from which they had almost entirely vanished.

Every evening at sunset the gulls take wing and fly away over the miles of sooty chimneys down stream, and spend the night on the quieter mud flats at the mouth of the Estuary. In summer they entirely desert the upper reaches and repair to their favourite breeding haunts.

The nearest of these lies on the Essex coast not 50 miles from London, and it was to this, the most famous of them, that I made my way this summer for the first time. Here I wish to apologise for an act of trespass which, however, I feel sure the courteous owner would be the first to forgive.

Great expectations are often disappointed; but I had not been prepared for such a falsification of all my hopes as I there experienced.

I landed in the first week of July from a small boat on the Tollesbury marshes, and made at once for a great stretch of water lined with rushes called Pennyhole Fleet, where I expected to find my friends.[1]

A great white flock of common gulls and some larger ones rose at my approach, but they were only there apparently resting and were not what I was in search of.

Bye and bye I caught sight of a few of my quarry circling high in the air over a spot some distance off. Advancing rapidly, I discovered that this was the colony I was looking for, and simultaneously I had to bear the brunt of a determined attack by these brave and fearless birds. Perceiving where my path was leading me, with wild screams, like the broken caw of a rook, they swooped down from their aërial positions, and occasionally I had to wave my cap and arms to keep them at a respectful distance.

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[1] A very full and interesting description of this Gullery in 1888 was given by Mr. Fitch and Mr. Christy in a paper, "A Visit to an Essex Gullery, with Notes on the Birds frequenting the Marshes round Tollesbury," in the ESSEX NATURALIST, vol. ii., pp. 193-198.—ED.

This daring conduct rather reassured me; for the moment I was somewhat suspicious of that big flock of gulls I had just left, but in face of the bold behaviour of the black-headed ones, I did not think that any of the former would have dared to have approached the colony with egg-stealing intentions. Having faced the onslaught and disregarded the menacing cries, I attained the edge of the gulls' nursery.

This was a small, square pond, barely covered with water and surrounded by high banks. The stunted rushes and flags growing up from the surface were not thick enough to hide the nests. As I was wearing sea-boots, I waded out into the middle of the pond, and came close to the nests, of which there were only five or six at the most, and only a few of these contained two or three eggs.

Seeing, too, that there were at most but 20 birds, instead of the 100 I had expected, who were still wheeling and circling over my head in the utmost excitement and consternation, my disappointment can be better imagined than described.

The nests are very substantial structures, built of sedge and rushes, rising island-like from the mud and raised well above the water.

Just as I was leaving I turned again to have another look, and then I discovered a young gull standing up quite alone on one of the larger nests; and turning again a moment after, I found it had been joined by a second. Doubtless they had been crouching among the superincumbent rushes, possibly covered over by the parent birds and hidden in this manner while I was at close quarters.

With very despondent feelings I wandered off across the rest of the broad, flat marshes, but though I saw innumerable wild duck on the fleets and shadows, I could make out no more black-headed gulls.

I hasten, however, to reassure my readers. We need not jump at once to the conclusion that the birds are deserting their breeding grounds. My visit was undertaken somewhat late in the season (July), although that cannot account for the paucity of birds; but it seems to be the consensus of expert opinion that the cause for the great decrease in the number of the gulls is entirely owing to the absence of their accustomed food, caused by the devastating tidal overflow last winter. Doubtless when the insect food, on which the birds depend, re-appears, the gulls will also return in their accustomed numbers.

It seems that during the breeding season these birds subsist on, or perhaps their young demand, a diet of insect life and grubs from the dank, moist fresh-water marshes, and these the inrush of salt-water had unfortunately destroyed.

Mr. Miller Christy kindly wrote and gave the same reasons as his opinion.

Dr. Salter, who owns the marshes, wrote in the like strain, regretting to hear of the diminution in the number of the gulls, and said further that quantities of Pochards which usually bred there had deserted this year, he supposed from the same cause.

Mr. Champion Russell, of "Stubbers," near Romford, also courteously informed me that the same thing had occurred in the large gullery at St. Osyth, where there were only five or six nests this summer.[2]

These are the only two Gulleries I know of in Essex; but considering the nature of the vast stretches of swamps and saltings in the Hamford Waters, perhaps, through the medium of the ESSEX NATURALIST, I may be informed that there is happily another colony there.

One word in conclusion. These colonies of Black-headed Gulls are among the most valuable possessions of bird life we treasure in the county of Essex. Amongst others, for the following reasons:—

1. The beauty of the bird is well known, especially in the breeding season when it assumes its little black hood, its orange-red beak and scarlet legs.

2. The breeding places of this bird are very rare indeed in the South of England; they are daily becoming rarer, and those in Essex are the nearest to the Metropolis.

3. They are survivals of colonies that have existed in the county for centuries, and the only seabirds that breed there in any large numbers.

4. Their curious habit of nesting in company render them particularly interesting and instructive to the patient investigator.

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[2] See note on this breeding-place by Mr. Fitch in ESSEX NATURALIST, vol. iii., 188. When he visited it, in June, 1889, he counted between 30 and 40 nests.—ED.

And, fifthly, upon the continued welfare and prosperity of these local colonies in a great measure depends the delight and pleasure the birds afford to city folk, when in wintry weather they wend their flight up the busy highway of the Thames, to pick up crumbs of comfort from the London cockney.

I only wish the office of looking after and protecting these beautiful and interesting birds could be made a county or a national duty.

Next year I shall hope to send you a more flourishing account.

[At the reading of the paper some conversation took place as to the particular kinds of gulls frequenting the London waters. We have to thank Mr. Howard Saunders, F.L.S., F.Z.S., the acknowledged authority on the Laridæ, for some remarks on this point, which fully confirm Mr. Clark's observations. Mr. Saunders writes :—" Undoubtedly the gulls which resort to our London Park waters and also to the Thames, are mainly *Larus ridibundus*; there are, however, some *L. canus* (Common Gull) ; and all the large gulls, *L. argentatus* (Herring Gull), *L. fuscus* (Lesser black-backed Gull), and *L. marinus* (Great Black-backed Gull) may be seen, the latter rarely. I do not remember the Kittiwake (*Rissa tridactyla*) in the Parks." This last remark of Mr. Saunders has reference to a communication to the *Times*, alluding to Kittiwakes supposed to have been seen in St. James' Park. In an interesting article in the *Standard* on November 21st, 1896, the following remarks occur :—

" The gulls which are now to be observed on the Thames are not present in such hosts as in the winter of 1894-5, and certainly not for the same reason. It was owing to the severe and tempestuous weather that vast numbers of sea birds of many kinds were driven on that occasion far inland by the impossibility of picking up a living at sea or round the coast. Their migration was not confined to the Thames, but extended over nearly the whole of the northern and eastern coasts; and in the parlour of many a country inn in those parts may be seen little auks, guillemots, and rare gulls, which fell to the gun, or were picked up dead from exhaustion, and are now set up, in more or less life-like attitudes, mute witnesses to the skill of the local bird-stuffer. The bulk of our visitors two years ago were blackheaded gulls, and most of the birds now visible belong to the same species. The young ones, who are more numerous may be distinguished by the black-tipped tail and the yellowish-brown feet, legs, and bill, while in the older ones the black bar at the tail-tip is wanting, and the feet, legs, and bill are red. The dark hood, from which these birds derive their popular name, is assumed during the breeding season, and is due to a change of colour, not to a moult. It is scarcely necessary to say that none of them show the hood now, though there are some dark markings on the head. It would be interesting to know whence these birds come, and why they are found upon the river in this mild, open weather It may be that we are on the eve of a periodical visitation, if, indeed, it has not already begun." * * * * "The attachment of the lower animals to man, is, in very many cases, a selfish one; and it may be that the previous feeding of the gulls has had not a little to do with their return now. That some birds have memory for places is proved in many ways—notably by the feats of homing pigeons, which are due, not, as was formerly supposed, to a mysterious faculty for finding their way; but to an acquired knowledge of the route to be traversed. The gulls having travelled from the coast of the Thames and back, it would not be a difficult matter for them to repeat the journey, especially if there were the stimulative remembrance of the manner in which they were treated on a former visit. They are eminently gregarious, and the flight up the river of a few, whether impelled by faint memories of good times gone by, or merely exploring, would be a signal for others to follow. Then there is another factor to be taken into account; the facility with which these birds accommodate themselves to widely different situations. They are as much at home searching for food in the ploughed fields of Norfolk, in the breeding season, as they are along the sandy or muddy flats of the coast in the Winter. And this necessarily argues considerable adaptability in the matter of diet. The stomachs of some that have been examined have contained grain and other vegetable matter. One excellent observer saw some of them 'dashing round lofty elms, catching cockchafers,' another records their fondness for moths, and a third writes of them, when pressed by hunger, as 'turning themselves into swallows and trying to catch the mayfly and the daddy longlegs.' Birds which are practically omnivorous, as these gulls are, will readily pick up a living where those of more restricted tastes would starve. For them the flotsam and jetsam of a great river, with miles of thickly-populated banks, must offer a fair food supply, even though the alms of sympathetic Londoners should fail. If there were breeding-places as near to London as there are to Glasgow, we might expect that within a little time, these birds would be as common on the Thames as they are on the Clyde At any rate, their visit at this time, when one would think food in plenty might be had for the searching on the coast, is exceedingly interesting."]

REPORT OF THE CLUB'S DELEGATE AT THE MEETING OF THE CORRESPONDING SOCIETIES' COMMITTEE OF THE BRITISH ASSOCIATION AT BRISTOL, SEPTEMBER, 1898.

[*Read December 17th, 1898*]

THE Conference was held at the University College, Bristol, on September 8th and 13th. The proceedings at the first meeting were opened by our distinguished Honorary Member, Mr. W. Whitaker, F.R.S., who introduced the subject of Coast Erosion. All persons, he said, were interested in the scenery of our shores, whether they lived in counties bordering the sea or wholly inland. It was now possible to obtain maps of six inches to the mile for all parts of the country, and on maps of this large scale it was easy to measure the amount of loss sustained at any point on the coast with approximate accuracy. In illustrating the loss sustained in certain places, he mentioned Sheppey. On the first visit of the Geologists' Association there, many years ago, the church and churchyard at Warden Point were both intact; some years later the churchyard had been partly destroyed, and coffins were seen sticking out from the edge of the cliff. The latest visit was last summer, when both church and churchyard had disappeared. Another form of marine encroachment had been well displayed at Aldeburgh, in Suffolk, during the visit of the Geologists' Association there last spring. During the storm in November, 1897, masses of shingle had been heaped up in the gardens and against the walls of houses and sheds, causing much injury to and destruction of property. The help of the photographer was extremely valuable in giving an accurate record of the effects of a storm, the damage done by natural forces of this kind being often much obscured in a very short time. As to the economical aspect of the question, there were two things especially worthy of attention: (1) The removal of shingle from any part of the shore; (2) the quarrying of stone on the faces of sea cliffs. It was seldom, if ever, wise to allow either operation to take place. Archæologists would be interested in noting spots where old British camps had been partly destroyed by the sea. Observations on the changes which had taken place since prehistoric times, would help us to predict the probable changes of the future.[1]

In the discussion which followed, Mr. W. H. Wheeler attributed the movement of shingle along our shores to the tides, and not to the winds, and thought the retention of shingle a better protection than a sea wall. Prof. H. E. Armstrong recommended that photographs should be taken by means of the photo-theodolite instead of in the ordinary way. Mr. Gray said that the Belfast Naturalists' Field Club had paid much attention to the subject, and were going to issue a special report on it next year. And Mr. A. T. Walmisley advocated the use of groynes, remarking that sea-walls were most useful when they were built a short distance in front of the cliff to be protected, not close to it. Waves might then rush up the face of the wall without touching the cliff. Mr. Clement Reid referred to the waste of land on the west coast; Mr. J. Spiller to the encroachments of the sea at Southwold, in Suffolk; Mr. G. J. Symons to marine inroads at Bognor, and Mr. T. W. Shore to the legal aspects of the matter.

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[1] Details of temporary and permanent effects of the high tide of November 29th, 1897, on the east coast, will be found in the present volume of the ESSEX NATURALIST, *ante* pp. 277 297, 365, and in the present part, p. 297.—ED.

Mr. Vaughan Cornish had come to the conclusion that the special protection of one part of the coast involved injury to that of the rest of the district, and that no local work for shore protection should be begun until it had been sanctioned by a Government Board. He thought it was most desirable in any study of the effects of Coast Erosion to endeavour to obtain the services of the Coast Guard, who were always at work all round the shores of the British Isles. The proposition that it was desirable to endeavour to obtain the services of the Coast Guard was supported by Mr. Wheeler, Mr. Spiller, and Mr. Scott-Elliott, and met with general acceptance. Then Prof. Meldola moved the following resolution:—

> "That the Council of the British Association be requested to bring under the notice of the Admiralty the importance of securing systematic observations upon the erosion of the sea coasts of the United Kingdom, and that the co-operation of the Coast-guard might be profitably secured for this purpose."

This resolution was seconded by Mr. Gray and carried.

At the second meeting of the Conference Mr. Whitaker announced that action had been taken with regard to the above resolution on Coast Erosion. It had been submitted to the Committees of the Geological and of the Geographical Sections, both of which unanimously supported the recommendations it contained.

The chief subject discussed at the second meeting of the Conference of Delegates was the desirability of "Uniformity of Size of Pages of Scientific Societies' Publications." It was introduced by Prof. Silvanus P. Thompson, who remarked that all who were engaged in scientific investigations were greatly indebted to their fellow workers for reprinted papers on subjects in which they were interested. If uniform in size these papers were easily bound together and permanently preserved. The desirability of encouraging uniformity in size had caused Section A, some four years ago, to promote the formation of a Committee having this object in view. The Report of this Committee would be found in the *Ipswich Report of the British Association*, pp. 77-79 (1895).

The standard octavo size there recommended was: Paper, demy, the pages measuring, when uncut, $5\frac{5}{8}$ in. × $8\frac{3}{4}$ in.[2] The standard quarto size was: Paper *demy*, the pages measuring, when uncut, 8¾ in. wide × 11¼ in. high. Each article should begin a page, and, if possible, a right hand page. It is then possible to bind up any article with others on the same subject without having also to bind up the last half page of another paper.

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[2] This is, of course, the size of the pages of the ESSEX NATURALIST and other publications of the Club.—ED.

Many other details dealing with what is desirable in scientific publications may be found, with illustrations, in the Report mentioned.

Prof. Meldola remarked that the promotion of this uniformity of size had been one of the original functions of these Conferences, and he hoped that the suggestions of Prof. Thompson might bear fruit. The Corresponding Societies' Committee had a considerable collection of the publications of the Corresponding Societies at Burlington House, and a glance at their shelves revealed considerable diversity of size. Mr. Clement Reid suggested that the original paging should be preserved in reprints; and the Rev. J. O. Bevan hoped that the attention of the Corresponding Societies might be drawn to the matter by the delegates, and that the *general* interest in uniformity might be dwelt upon.

Mr. G. J. Symons, representing Section A, drew attention to the case of Prof. Milne, who was then making important observations on earthquake tremors in a house in the Isle of Wight, which was in so bad a sanitary condition that many fears were entertained with regard to his health. It was much to be wished that either the Government or some rich man might lend a water-tight and healthy house to Prof. Milne for a few years And Mr. Beeby Thompson, representing Section C, asked for the assistance of some rich person or persons to allow of the uncovering and removal of a fine specimen of a Dinosaur which had recently been discovered near Northampton.

As regards Section H, the Chairman (Dr. Garson) wished to draw the attention of the Conference to the Ethnographical Survey, an investigation in which few local societies were co-operating. And Mr. Hartland, the Secretary of the Ethnographical Survey Committee, said that it would greatly help his Committee if each of the Corresponding Societies would take up one or more branches of this inquiry. He had explained at previous Conferences that it was by no means necessary that all branches should be taken up everywhere. He added that he would be happy to send to the Corresponding Societies all the information they might require as to the nature of the work, and the way in which the Committee wished it to be carried on.

In a brief Report of the Corresponding Societies Committee, which was in the hands of every delegate present, are the following remarks:—

"The Committee observe with satisfaction that the Corresponding Societies steadily increase in number, and that the total number of members comprising them also increases. For example, in the *British Association Report of the Bath Meeting* in 1888 there is a list of 55 Corresponding Societies, having a total of 18,950 members. The Toronto *Report* of last year shows 69 Corresponding Societies, having a total of 22,395 members. On the other hand, the average number of members in each society appears to have slightly decreased having been between 344 and 345 in 1888, and between 324 and 325 in 1897, but this is accounted for by the collapse of two federations -the Midland Union and the Cumberland and Westmoreland Association—and the withdrawal of the Royal Scottish Geographical Society between the two periods. For in 1888 these three associations numbered among them 4,006 members. as many as would be found in eleven or twelve average societies."

The Committee are also pleased to know that as the great majority of the Societies, the main purpose of whose existence is local scientific investigation, are now on the list of Corresponding Societies, their catalogue of papers approximates to completeness more and more each year as a record of local work. With regard to a few societies of more or less importance not on the list, the Committee remark that though "local" in the sense of having their headquarters out of London, they do not for the most part make local work their main object, and add:—

"Fortunately, in most cases, information as to the titles and authors of papers read before local societies, not Corresponding Societies of the British Association, may be obtained from the *Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland*, C. Griffin & Co., London. The *Year Book* appears every spring, and contains lists of papers read in the previous year. It will be found that the *Year Book* and the British Association *Index* combined leave little to be desired by the inquirer after papers on any locality in the British Isles."

In the "Index of the more important papers, and especially those referring to Local Scientific Investigations, published by named societies during the year ending June 1st, 1898," appended to the report, the Essex Field Club is credited with 25 papers, including the *Mammals, Reptiles and Fishes of Essex*, published during the said twelve months.

T. V. HOLMES, *Sec. Cor. Soc. Committee,*
Delegate, Essex Field Club.

"TRULY DERELICT. A CURIOUS CORNER OF ESSEX."

THE *Daily News* of July 27th contained a special article under the above title which gave a vivid picture of the destruction wrought by the great tide of November 29th, 1897. The story begins:—

"A few years ago it was the custom to talk and write about 'Derelict Essex.' Though at that time there were farms actually deserted, the description was rather pictorial than literal, and was meant to convey the idea that, of all the agricultural depression that was to be deplored in England, that of Essex was the most hopeless. It is not, however, generally known that there are at this moment some miles of this unfortunate county that do directly illustrate the meaning of the adjective 'derelict,' and, concurrently, in the very opposite sense, illustrate also the meaning of the same term used as a substantive. In other words, there is within forty miles of London a large tract of country which is deserted and abandoned; but, instead of being left dry by the retirement of the water, it is land put out of use by an abnormal inundation, which has, up to the present moment, completely mastered the unfortunate farmers. I have just returned from an inspection of this extraordinary spectacle of farms under water, and of farmers who can look for no harvest-home in this year of plenty and promise. Who can imagine a more dismal position than that of an agriculturist smelling the fragrant hay which his neighbour, close by on the rising ground, is carrying to build up the great rick; surveying from the top of his stile the glorious fields of poppy-bordered wheat and barley taking warm colour every day in the July sunshine; yet knowing that never a crop can this summer be his? This is, alas, the hard situation of the occupiers who have the misfortune to possess homesteads along the banks of the river Crouch, from Creeksea westwards to beyond North Fambridge.

"The original cause of this miserable interruption of all agricultural operations was a phenomenally high tide, unhappily occurring during the memorable gale of the 28th and 29th November last. Fragmentary accounts of the damage done appeared in the newspapers at the time, but there intervened a wonderful run of sensational subjects, and public attention was soon diverted from flooded Essex. The bright half-crown quarterly journal of the Essex Field Club ('Essex Naturalist') in its May issue placed the corrected facts on careful record, and they tell of the widespread destruction wrought on the coast and borderlands of the Thames, Blackwater, Colne and Crouch estuaries—mostly low-lying country that at high tide in the creeks is below the level of the water. The pastures have, therefore, to be protected by league upon league of solid earth embankments from eight to ten feet high, and these have in an ordinary way been sufficient, though small breaches have been always occurring from temporary causes."

The writer then gives the details of the flood, which have already been described in the E.N., and proceeds:—

"In two days there were 50,000 acres of land thus flooded. As will presently be seen, little time was lost in turning out the invader and repairing and strengthening the walls, where there were organizations to take the task in hand. It is the corner lacking such privileges that is, even till to-day, truly derelict, because no funds have been found available for remedy.

"This neglected corner begins, to the view of the railway traveller, soon after Wickford Station is passed, and is worst perhaps at North Fambridge. Towards the pretty yachting haunt of Burnham-on-Crouch there are local authorities who exercise control, and the country side is here and henceforth green and smiling as of yore. To see the worst of the flooded district I visited Westwick Farm, owned and occupied by Mr. Armour, an intelligent and thrifty North Briton, who here bought himself a freehold of 174 acres, built himself a house, and settled down with his family to the cultivation of wheat, mangold, oats, peas, and pastures. Last year it was almost entirely under grass. The farm is in a bend of the river, and stood, therefore, in the direct advance of the menacing tide; to-day Mr. Armour has but 24 acres out of 174 that are unflooded. He took me out to see how the water had overrun even his kitchen garden, and lapped around the foundations of his barns, stopping little short of the residence itself. From one of his upper windows he pointed out the breaches, and the partly obliterated land marks. Water, from this point of view, was everywhere. One set of farm buildings was an island in the midst of a great lake; there were small patches on the surface little larger than the heads of cabbages, and lines of dots such as the drift-net corks will make on the fishing grounds. I went again next morning when the tide was out; the seeming cabbage heads had then resolved themselves into oak and willow trees, and the lines of dots were the post tops of fences four bars high. It was most curious to note the change as the tide flowed out through the breaches. Gradually the original objects of the fields declared themselves--fences, knolls, ditches, trees, hedges, gates, and remnants of huts, to be left dry till next tide. Every scrap of vegetation had been killed." [1]

The article then discusses the question who is responsible for putting things right and reclaiming these miles of submerged farm-lands, if the owners be too poor to incur the expense, but the writer admits that we here find ourselves in a maze of difficulties. He concludes by asking, almost in despair of other remedy, "Has the Minister of Agriculture no interest and no voice in a crisis like this?"

THE ESSEX FIELD CLUB.

INSPECTION OF THE WALTHAMSTOW RESERVOIRS OF THE EAST LONDON WATERWORKS COMPANY AND 180TH ORDINARY MEETING.

SATURDAY, JULY 2ND, 1898.

The object of the meeting was to complete the inspection of the Works, in continuation of the visit made by the Club to the Lea Bridge Pumping Station on June 29th, 1895 (see ESSEX NATURALIST, vol. ix., pp. 96-97). By the kindness of Col. Bryan, M.Inst. C.E., the Engineer to the Company, this was rendered possible.

The works are of the most extensive and interesting character. The Walthamstow Reservoirs are ten in number, and their "shore line" is nearly 13 miles! They cover over 300 acres and will store more than 1,200,000,000 gallons of water. About 45 million gallons a day are pumped, and the meter house will measure and record up to 60 million gallons per day.

During the excavations of the Reservoirs discoveries of great geological interest were made. The sections exposed during the work in 1868-69 were described by Dr. Henry Woodward, F.R.S., in the "Transactions of the

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[1] *cf.* Notes on the conditions at Fambridge in last part of E.N. *ante*, p. 375.

Essex Field Club, vol. iii., pp. 1-29, and lists of the Molluscan and Mammalian and other remains then obtained was given. A set of these specimens is in the British Museum and a smaller one in the Epping Forest Museum. The sections shown during the construction of the "Lady Warwick" Reservoirs in 1896-7 were described by Mr. T. Hay Wilson in the ESSEX NATURALIST for 1897, vol. x., p. 110. Lists of the Mollusca will also be found in Mr. J. E. Greenhill's pamphlet on "Prehistoric Hackney, Part II., Neolithic Age" (1883), and the Molluscan Fauna of the beds is fully discussed in Messrs. Kennard and Woodward's paper on "The Post-Pliocene Non-Marine Mollusca of Essex" in the ESSEX NATURALIST, vol. x., pp. 87-109. Reference should also be made to Mr. Holmes' paper on the "Geology of the Lea Valley" (E. N., vol. viii., pp. 198-201), the "Geology of Epping Forest" (E. N., vol. ix. pp. 161-165) and to Whitaker's "Geology of London and Part of the Thames Valley," vol. i, pp. 272-4.

The members assembled at 3 o'clock at the entrance near Tottenham Lock, nearly opposite the Old Ferry Boat Inn, an ancient hostelry, formerly well known to boating men on the Lea. Among those forming the party were Mr. Andrew Johnston, Mr. Eliot Howard, Dr. J. C. Thresh, Prof. Meldola, Mr. W. Crouch, Mr. Float, late Mayor of Maldon, and others. Mr. T. V. Holmes acted as Geological conductor. In the unavoidable absence of Col. Bryan, who had been called away into the country, Mr. Ashley, the Assistant Engineer to the Company, met the party at the gates, and to his kindness and efficiency as a guide the members were indebted for much of the interest of the afternoon. The weather was delightful, and the ramble along the crown of the sloping banks of the reservoirs was most enjoyable. In the spring the flora of these banks and those of the numerous ditches or rivulets is very varied and interesting. At the time of our visit, unfortunately, the grass of the slopes had just been cut for hay, and with it the flowers. The abundance of Water-Plantain (*Alisma*) and Arrow-head (*Saggittaria*) in the ditches was remarkable, and on some of the slopes the Dewberry (*Rubus cæsius*) was most luxuriant. It was stated that in the winter the number of birds frequenting the lakes was often great. The reservoirs were an attraction in themselves, but where they could boast a thickly-wooded island in the centre, they were exceedingly picturesque. Mr. Ashley did not favour the idea that the islands were raised in the centre with this intention, but thought it probable that they fulfilled the function of breaking the force of the impact on the sides of the reservoirs when waves several feet high were thrown up during south-westerly gales.

Mr. Scourfield (author of the papers on the Forest Entomostraca in late parts of the ESSEX NATURALIST) made several collections of these tiny animals in the reservoirs, chiefly in the hope of obtaining specimens of some of the rarer pelagic species such as *Leptodora hyalina*, which, it was thought, might possibly find a congenial home in pieces of water of such considerable size. None of these rarer species were found, but a very good series of gatherings was nevertheless obtained, including one species, *Prionocypris serrata*, which had not been previously obtained in the district (See *ante* p. 321.) Specimens of the rare fresh-water Copepod, *Eurytemora lacinulata*, which had only been previously found in the district at Higham Park, were also obtained. On the whole, the reservoirs seem likely to be extremely good collecting stations for the Entomostraca.

The pumping stations were visited, although not then at work, and Mr. Ashley demonstrated the action of the Water Meter—very ingenious and perfect pieces of apparatus. From forty-five to fifty million gallons of water a day are pumped, the supply being obtained from three sources---ten millions from the Thames at Sunbury, ten millions from the wells on the works, and the remainder from the Lea. There are several wells on the works, each of them 200 feet deep. Chalk is met with at about 150 feet, and into this the shaft is sunk for 50ft., so that the water derived from these sources is pure chalk water. Down the whole length of gravel soil the walls of the wells are lined with iron plates, which form huge protective cylinders against collapse. The process of filtration was explained. The bottom layer of the beds consists of a foot of white stones, about the size of hen's eggs. Above this there is a second layer of the same stones, about half the size, while the third and topmost layer consists of two feet of fine sand, brought specially for the purpose from Bedfordshire and Cornwall. There is a general opinion that this well water is extremely hard, but the idea is somewhat erroneous, as Mr. Ashley explained that at one of the wells on the works the water only attained seven degrees of hardness.

During the afternoon Mr. T. V. Holmes gave a *resumé* of the geology of the district, illustrated by maps and sections. It is unnecessary to do more than refer the reader to the papers above enumerated, as in them will be found the main facts.

At about 6 o'clock tea was taken at the "Ferry Boat" Inn, presided over by Mr. Howard, who had then joined the party. And afterwards an ORDINARY MEETING (the 180th) was held.

The following were elected members of the Club:—Mr. J. Oldham Braithwaite, and Mr. Alexander Scott, M.A., F.R.S,, of the Davy-Faraday Laboratory, Royal Institution.

It was announced that the site of the Uphall Camp, near Barking, had been sold the day before by auction. But the President took occasion to reassure the members by saying that he did not think the present owners would disturb the camp, inasmuch as he was one of them (see "Notes" *ante*, p 374).

Mr. W. Cole called attention to the abundance of the var. *b* (*patens*, Sibthorpe) of the common *Symphytum officinale* (Comfrey) on the banks of the navigation cutting of the Lea near Tottenham Lock, about half a mile from where they were then assembled. He could not claim this interesting form (with purple flowers) as Essex just yet, inasmuch as the old River Lea divided the Counties of Essex and Middlesex. He had never found *patens* in Essex, where in several places the ordinary yellow-flowered form of the Comfrey was very plentiful.

A paper by Mr. Worthington Smith on the "Implement made from a Stag's Antler from Wormingford," exhibited at the meeting on May 14th, was read by the Secretary (see E. N. *ante* pp. 310-12 and pp. 351-53).

A paper on the ,, Encroaching Sea on the East Coast," by Mr. Percy Clark, was in the absence of the author, read by Prof. Meldola (*ante* pp. 297-99)

The President said he questioned whether it would not be cheaper to maintain the walls than to keep up the endless series of lights which would be required to mark the shoals and quicksands. He did not know whether they knew the road from Queenborough to Flushing, but there were lights all along showing how shallow the water was, and what a very little rise in the land would be required to join them with Holland.

A very interesting discussion followed, carried on by the President, Prof. Meldola, Mr. Holmes, Mr. Float, Mr. W. Cole (who stated it was estimated that 5,000 acres had gone from Essex permanently as a consequence of the November overflow), and others, and thanks were voted to the authors of the papers.

Prof. Meldola proposed that a vote of thanks be accorded to Mr. Ashley for having made their visit to the Waterworks so interesting, and for the admirable and lucid explanations he had given them.

The President seconded, and the vote was carried with acclamation.

MEETING AT WITHAM, BLACK NOTLEY AND STISTED HALL.

SATURDAY, JULY 23rd, 1898.

The object and business of the Preliminary Conference between the three "East Anglian" Scientific Societies—the Norfolk and Norwich Natural History Society, the Ipswich Scientific Society and the Essex Field Club—is fully set forth in the separate article in the present volume (pp. 360-68). After the business of the Conference, lunch was served at the "Spread Eagle" Hotel, members of the other societies being guests of the Essex Field Club.

After luncheon, the remainder of the day was devoted to a driving excursion through Faulkbourne, White Notley, Black Notley, Bulford Mill, and Cressing, to Stisted Hall, the beautiful residence of the Mayor of Colchester. It is unnecessary to repeat the full account of Ray's birthplace, life at Black Notley and tomb, given in the report of the former visit of the Club in July, 1895 (see report of meeting in the *Proceedings E. F. C.*, vol. iv. pp. clvii.-clxxii. and to Prof. Boulger's paper on "The Domestic Life of John Ray at Black Notley" and Mr. E. A. Fitch's on "John Ray as an Entomologist" in the same volume). A halt was made at "Dewlands," Ray's home for the twenty years preceding his death, where the party was welcomed by the new owner, Mr. Turner. Prof. Boulger was the expositor here, and said that "Dewlands" was built by Ray for his mother, and at her death in 1679 he moved thither himself from Faulkbourne Hall, where he was engaged as tutor. At "Dewlands" his later works were written, and there he died. The pilgrimage was continued to the churchyard, where, by the tomb of Ray, the rector (Rev. Augustus Shears), mentioned that the date of birth commonly accepted, and placed on the grave, was shown by the parish register to be five months too soon.—Prof. Boulger said that both the dates of birth and death upon the tomb (which was erected by the Ray Society) were wrong, there being evidence from Ray's own words, that he was born in 1627, not 1628, while his death took place in 1704-5 not 1705-6.

A long and delightful drive by Bulford Mill and Cressing to Stisted followed, and the party was most cordially welcomed by the Mayor of Colchester (Alderman J. N. Paxman), at his beautiful domain, Stisted Hall, which was thus described on the programme for the day:—"Stisted Hall, built in 1826, is a noble mansion of white brick, with an Ionic portico standing in a park of 130 acres. From the elevation of the site it commands fine woodland scenery, and in the park are some grand oaks. One described by Mr. Shenstone in his paper on 'The Oak Tree in Essex,' (E. N., vol. viii.) has boughs extending 99 feet; a tree which, in Mr. Shenstone's opinion, is destined in future years to be one of the most remarkable oaks in the county. In the grounds are some ancient and interesting fish-ponds." The members walked round the beautiful gardens, which were in the prime of summer beauty, and the tulip trees in bloom, a standard magnolia, and the magnificent cedar trees were particularly admired. Mr. Paxman subsequently entertained his guests in most hospitable fashion, high tea being served in a marquee on the lawn, the Mayoress of Colchester (Mrs. William Paxman) also being present to welcome the party.

A Meeting was subsequently held in the Marquee, Mr. D. Howard in the chair. A cordial vote of thanks was passed to the Mayor for his kindness and hospitality on the proposal of the Chairman, seconded by Mr. J. C. Shenstone.

In replying, His Worship expressed the pleasure it had given him to know that that was the occasion of a union between the societies of the counties of Essex, Suffolk and Norfolk, and hoped it would be found for their mutual benefit and profit.

Mr. Shenstone exhibited living specimens of some interesting plants gathered a few days before in a locality not far from Chelmsford. Amongst them, the peculiarly Essex plant, *Lathyrus tuberosus*, attracted much attention, and Mr. Shenstone reported that it was still fairly abundant. He had also brought specimens of *Bupleurum rotundifolium*, *Lathyrus aphaca* and *Galium tricorne* and other notable plants.

Mr. Shenstone stated that he had recently been giving attention to photographing living specimens of British Wild-flowers. He considered that photography was capable of a much wider application to their work by naturalists than was generally attempted. Although the illustrations usually given in floras serve for identification purposes, they often give a very poor idea of the natural habits and luxuriance of the living plants. Mr. Shenstone showed a small series of very fine photographs (part of a collection of many hundreds) to prove his contention that when carefully done, the photograph preserves the natural appearances of the plants in a most valuable and instructive way for reference and study, and he thought that the method might be adopted for book illustration.

Prof. Boulger, F.L.S., F.G.S., followed by an elaborate paper on "Ray's Contemporaries in Biology." In a masterly manner he sketched the standpoints of those naturalists who early made some attempt at classification, pleaded for due allowance to be made for the influence of Lord Bacon on scientific method, and awarded Ray a high position because he not only seized on what was most germane in the work of those who immediately preceded, or who were contemporary with him, but went beyond them in the recognition of sex in plants.

Votes of thanks were given to Mr. Shenstone and Prof. Boulger, and after taking leave of their kind host, the party was driven back in the cool of the evening to Witham Station to catch trains to Ipswich, Colchester, Maldon and London, having spent an exceedingly pleasant day, and hope was expressed that this would be the commencement of many such reunions of East Anglian naturalists.

MEETING AT BRAINTREE AND 181ST ORDINARY MEETING.

SATURDAY, OCTOBER 1ST, 1898.

Directors:—Rev. J. W. Kenworthy, M.A.; E. T. Newton, Esq., F.R.S., F.G.S.; T. V. Holmes, Esq., F.G.S., F. Anth. Inst.; and W. H. Dalton, F.G.S.

This excursion was arranged at the suggestion and kind invitation of the Vicar of Braintree, the Rev. J. W. Kenworthy The Club had not before visited the town, which, however, presents many points of interest to the naturalist and archæologist in reminiscences of the friends and co-workers of John Ray, and in the numerous relics of early occupation discovered in the neighbourhood. One principal object of the meeting was to afford an opportunity for the careful examination of the collection of mammalian remains, flint implements and other works of man, &c., which Mr. Kenworthy has obtained during the past fourteen or fifteen years, and to view the pits and sites in the vicinity of Braintree where these were found, which, in his opinion, were of considerable geological and archæological importance.

Braintree stands upon the old Roman "Stane Street" from Verulamium to Camalodunum. The site was occupied by Britons, Saxons, and Normans. There is an earthwork of British or Roman construction on the military way, and the Church is stated to stand within an ancient encampment. The town still retains many XVI. Century domestic houses and hostelries, and upon these last in the old days its prosperity depended. A room, traditionally noted as occupied by Queen Elizabeth on her visits, yet remains in its ancient state, with frescoes and armorial bearings.

Samuel Dale, F.R.S., botanist and zoologist, lived at Braintree and Bocking, and was the friend and contemporary of Ray and of Dr. Benjamin Allen, author of the "Natural History of the Chalybeat and Purging Waters of England" (1699), and "The Natural History of the Mineral Waters of Great Britain: To which is added some observations of the Cicendela or Glow-worm" (1711). A notice of Allen by Mr. Fitch appeared in the ESSEX NATURALIST, vol. iv., pp. 192-3. Mr. Kenworthy possesses an interesting memorial of the Braintree naturalist in his "Common-place Book," full of observations on many subjects. Mr. Fitch says: "Dr. Allen's remarks and observations on the life-histories of various insects, especially the glow-worm, and also on the oyster, snails, &c., show him to have been a close and acute observer, in every respect far in advance of his age."

The assembly place was the parish Church of St. Michael, where the members of the party were met by the Vicar at about 11 o'clock. The points of the Church were demonstrated by Mr. Kenworthy, who gave here and indeed throughout the day many bright impromptu lecturettes, which were much appreciated by those present. The tower and nave of the Church date from 1199. The Church was enlarged in 1522, and again in 1856. The south chancel aisle, or Chantry Chapel, was inspected with great interest. This portion of the Church was built, or at any rate completed, in 1535, and richly endowed, but two years later by the Act of Henry VIII. suffered confiscation, with the other chantries and free chapels all over the kingdom. The original roof remains and is one of great beauty. The carvings are rich and deep and the oak bosses show the armorial bearings of the Grocers' Company and other benefactors. Other bosses have religious symbols, and the letters M.R. crowned, on a shield. This chapel formerly was used as a school, and it was there that John Ray, the naturalist, and Challis, the astronomer, and other eminent men began their education.

Having viewed the Church, the party was cordially received at the Vicarage by Mr. and Mrs. Kenworthy, and some time was occupied in inspecting the pictures and objects of *Vertu* with which the house is filled. Roman relics and mediæval curiosities have a little museum to themselves. In the courtyard were displayed Mr. Kenworthy's collection of neolithic remains and bones of animals obtained from the excavations in the valley of the Pod or Brain, where he has discovered a Lake-settlement of early man of Neolithic age.

At one o'clock the party dispersed for luncheon and to view the town, re-assembling again an hour later at the Vicarage, where wagonettes were in waiting to take them to the pits.

No attempt can here be made to describe the many interesting geological sections pointed out by Mr. Kenworthy. This will be done in papers to be subsequently published. The Drift series from the Westleton Beds upwards may be seen in existing excavations. The valley of the Pod Brook at the foot of Skitts Hill and Mr. James Brown's pits were visited, and it was here that the most valuable discoveries had been made by Mr. Kenworthy—viz., a Fascine Lake-dwelling in the alluvial deposits of the river, containing abundant remains of human occupation and bones of animals, wooden and flint tools, &c., &c. This most interesting station will be described by the discoverer in the next volume of the Essex Naturalist. On the slope of the hill to the south of the pits Mr. Kenworthy had found in the Brick-earths bones of Mammoth and Palæolithic flakes. The next stopping-place was at a gravel pit on the Coggeshall road about half-a-mile from Braintree, belonging to Mr. Parmenter. It is on a tongue of land (about 220ft. O.D.) dividing the Pant from the Pod River, and is about 45 feet deep. Chalky Boulder-Clay, 10 or 12ft. curiously mixed up with the wreck of Mid-glacial beds and lumps of London Clay; then the Mid-glacial beds above contorted gravels, and at the bottom Westleton Sands. Such a deep and fine section has not been exposed in the neighbourhood in the memory of the workmen. Although so deep, water has not yet occurred. Mr. E. T. Newton, Mr. T. V. Holmes, and Mr. W. H. Dalton, made remarks on this section, which was greatly admired and declared to be alone worth a visit to Braintree.

Before returning to the town a visit was paid to Mr. S. C. Parmenter's grounds at "Mount House," where an embankment was pointed out which appeared to have formed part of an ancient camp.

Mr. and Mrs. Kenworthy entertained the party at tea in the National Schoolroom.

Afterwards an ORDINARY MEETING of the Club (the 181st) was held, Prof. R. Meldola, F.R.S., *Vice-President*, in the chair.

The following were elected members :— Mr. Robert Colsell, Dr. Robert Jones, and Mr. D. J. Scourfield.

Prof. Meldola proposed that a hearty vote of thanks should be given to the Rev. J. W. Kenworthy and Mrs. Kenworthy for their kindness in organising the meeting and for the hospitality shown that evening. Under the Vicar's guidance they had had an opportunity of seeing a most interesting district, and Mr. Kenworthy's efforts in seeking out and preserving so many evidences of the presence of early man in the neighbourhood were worthy of the greatest praise. If they had more such observers in other parts of the County, the cause of science would be greatly benefitted.

Mr. Kenworthy, in reply, said that it was a very pleasant day for him. He had looked forward to the visit of the Club, and he had had the greatest satisfaction in showing to his fellow members the results of his labours in the pits around Braintree. It was also a great pleasure to Mrs. Kenworthy and himself to entertain the Club at tea that afternoon.

In the absence of the Author, Mr. Cole read a paper entitled:— "Observations on the Implement made from a Deer's Antler in the Museum of the Essex Field Club," by Mr. Edward Lovett (see *ante* p. 351).

Mr. Kenworthy exhibited and remarked upon a collection of the bones of Pleistocene Mammalia, Mollusca, Palæolithic "Flakes," &c., recently obtained by him at Clacton, Essex, from what appeared to be an extension of the Cromer "Forest-bed."

Mr. E. T. Newton, F.R.S., also spoke concerning the collection and Mr. W. H. Dalton made some observations on the Geology of Clacton; but all these observations will be most appropriately given when the specimens and their mode of occurrence is described in a future part of the ESSEX NATURALIST.

In responding to the vote of thanks, the Vicar said he should have much pleasure in presenting the whole of the Clacton "finds" to the Museum of the Club.

The remainder of the evening was spent in further examination of Mr. Kenworthy's collections, and the members left Braintree by the 7.10 train for Witham Junction.

SPECIAL MEETING AND 182ND ORDINARY MEETING.

TUESDAY, OCTOBER 4TH, 1898.

In accordance with notice a SPECIAL MEETING of the members of the Club was held in the rooms of the Essex County Council, 35, New Broad Street, E.C. (by kind permission of the Chairman of the Council, Andrew Johnston, Esq.) at 6.30 o'clock, Mr. David Howard, President, in the chair.

The Secretary having read the formal notice of the meeting. Mr. Howard gave a *resumé* of the steps which had been taken by the Council since the Special Meeting on January 2nd last, with respect to the arrangement with

Mr. Chancellor and those acting with him in connection with the goods at the Museum at Chelmsford, and also with respect to the agreement with the Corporation of West Ham. The President concluded by moving:—

> "That the first ten words in Rule xxv. be altered so as to read: "*The Museum and Library shall be situated in Essex,*" and that consequent alterations be made throughout the Rules."

Mr. F. H. Varley seconded the resolution.

The Rev. W. S. Lach-Szyrma supported.

The resolution was put to the meeting and carried unanimously.

The President expressed the great satisfaction of himself and the Council that this matter which had so long occupied them had now been brought to a conclusion.

The President then moved the resolution respecting the agreement with the Corporation of West Ham set out *ante* pages 343-46.

Mr. Wilfred M. Webb seconded, and Mr. Chalkley Gould spoke in support.

The resolution was carried unanimously.

Mr. F. W. Elliott then moved:—

> "That the best thanks of the Club be accorded to Mr. H. I. Coburn, the *Hon. Solicitor* to the Club, and to Mr. W. C. Dare, the *Hon. Counsel*, for their great care and trouble taken in the various legal and other negotiations connected with the removal of the Museum from Chelmsford, and with the Agreement with the Borough of West Ham."

Mr. Walter Crouch, V.P., seconded the resolution, which was carried unanimously.

Mr. Coburn replied.

The resolution of thanks to Mr. Passmore Edwards, set out on page 341 *ante*, was put by the President and seconded by Mr. Corcoran. It was carried unanimously amid applause.

Mr. Chalkley Gould moved that:—

> "A cordial vote of thanks be given to the Secretary, Mr. W. Cole, for the great energy and care displayed in making the arrangements with the Corporation of West Ham, which had now been brought to so successful a conclusion."

Mr. Avory seconded and the President strongly supported the resolution, which was carried unanimously.

Mr. Cole replied.

Mr. F. H. Varley proposed: "That a most cordial and grateful vote of thanks be given to the President for his great trouble and care taken in these difficult negotiations, and for the loyal support he had given to the Club and to the Secretary throughout.

Mr. Alfred Lockyer seconded.

Mr. Varley put the resolution, which was carried unanimously amid applause.

Mr. Howard replied, and took occasion to thank the Technical Instruction Committee of the Corporation of West Ham for the wise and enlightened view they had taken in this matter.

An ORDINARY MEETING (the 182nd) was then held to elect a member. Mr. E. E. Hennesey, B.A., B.Sc., was elected a member of the Club.

The meeting then ended.

JOINT EXCURSION OF THE ESSEX ARCHÆOLOGICAL SOCIETY AND THE ESSEX FIELD CLUB TO THE DENEHOLES IN HANGMAN'S WOOD, NEAR GRAYS THURROCK.

SATURDAY, OCTOBER 8TH, 1898.

Many members of both the Essex Archæological Society and the Club having expressed a desire to view the Deneholes which had not been visited by the Essex Field Club since August 12th, 1893, the present meeting was arranged, by the kind permission of Captain Whitmore, the owner of the wood.

Directors :—Messrs. T. V. Holmes, F.G.S.; Miller Christy, F.L.S ; G. F. Beaumont, F.S.A.; and W. Cole, F.L.S.

The details were arranged by Mr. Cole on much the same lines as on previous descents. The Meeting was a whole-day one, and members and visitors began to assemble in the wood somewhat early in the fore-noon. The pit down which the entrance to the workings was effected was that known as " No. 4" in the two plans illustrating the account of the explorations in the first volume of the ESSEX NATURALIST. Shears and a stage were erected over the pit, and the descent was made in a wooden "cage" as on previous occasions. It is quite unnecessary to report the adventures of the day which were but a repetition of those of the former visits. We may reprint from the programme of the meeting a few details for the information of those who may not have seen the papers published in the *Transactions* of the Club, nor the elaborate report of the explorations (extending over six weeks) carried on by Mr. Holmes and Mr. W. Cole for the Club in 1884 and 1887 (ESSEX NAT. I. pp. 225-276) :—

"The deneholes in Hangman's Wood are more than fifty in number. They consist of narrow shafts about 80 feet deep, which give admission to the pits in the Chalk, which are from 14 to 20 feet high. The shaft is usually in or near the centre of the pit, and from it, in most cases, three chambers branch out on one side and three on the other, in a kind of double trefoil pattern. The largest chambers are those which are opposite the openings at the bottom of the shaft, and the greatest length of each cavern is that obtained by measuring the length of a straight line passing through the centre of the shaft to the ends of the opposite chambers. Originally separate, these deneholes are so close together that the thin chalk partition betweeen two chambers in adjacent pits has sometimes been accidentally fractured. Though there are, as already stated, more than 50 separate deneholes in Hangman's Wood, only five shafts are now open, the rest having fallen in at various periods. As a result of the explorations of the E.F.C., fourteen adjacent deneholes are now connected by underground tunnels, and it requires at least 25 minutes to ramble through the whole of the workings.

"The shafts are narrow, and were originally less than three feet in diameter. The geological section of each varies only in the slightest degree. The chalk appears to be lying nearly flat, but the thickness of the old river gravel at the surface varies slightly ; so does that of the chalk roof of the chambers; and the height of the caverns, as already mentioned, is somewhat variable. The shaft of the pit ("No. 3" on the plan published in the Report alluded to above), by which the descent has usually been made at previous meetings, presents the following section of strata traversed:—

	ft.	in.
"Old River Gravel	6	6
Thanet Sand	51	0
Chalk, roof of pit ..	4	6
,, height of chamber	18	0
	80	0

"The origin and *raison d'être* of these interesting pre-historic pits, which bear a general resemblance to those which occur at Crayford, Bexley, and other places on the Kentish side of the river Thames, is still to some extent a matter of conjecture, in spite of the extended work carried on at a great expense in 1884 and 1887, when the accumulations of Thanet-sand, chalk, and general debris were carefully sifted to the level of some of the original floors; but they are undoubtedly of great age, and in the opinion of the authors of the Report above mentioned, and of other observers with like experience, were used for the storage of food supplies in those early times when life and property were equally insecure, and our land was frequently invaded by foreign hordes. They were ancient in the time of Henry IV., and are mentioned and figured by Camden, Blaeu, and others, some 300 years ago; and at that time were considered of extreme antiquity. A summary of the old literature relating to the pits was given by Mr. Cole in *Jour. E.F.C.*, iii., pp. xxviii-xxxiv."

A hypothesis that the Deneholes were simply Chalk-pits has been for many years maintained by some archæologists and has been lately re-stated and advocated by Mr. Dawson in the *Geological Magazine*. A reply by Mr. T. V. Holmes has also appeared in the same periodical.

The pits were lighted with an abundance of candles, and the effects of the magnesium-light were frequently tried. The visitors were conducted in parties through the pits by Mr. T. V. Holmes and Messrs. W. and Henry A. Cole, who did all in their power to explain the special points of interest in the excavations. As on a previous occasion (see E.N., vii., p. 146) the explorers were grieved to notice the great damage done by unauthorised visitors since the work ceased in 1887- No. 3 pit, formerly the finest example, has been irretrievably ruined.

Some 50 or 60 persons descended throughout the day, and it was not until quite late in the afternoon that the tired "Conductors" wended their way back to Grays for tea and trains home.

References to some recent papers on the Deneholes will be found in the "Notes" in the succeeding parts of the E.N. In the present state of the evidence, each side will maintain its own opinion; the question might be conclusively decided if a denehole could be found which had become closed soon after its abandonment by its makers or users, and had remained so until the present time.

THE 183RD ORDINARY MEETING.

SATURDAY, DECEMBER 17TH, 1898.

The 183rd ORDINARY MEETING was held in the Physical Theatre of the Municipal Technical Institute, Romford-road, Stratford, at 4 o'clock p.m., Professor R. Meldola, F.R S., *Vice-President*, in the chair.

The Chairman proposed that the Club should pass a cordial vote of thanks to the Technical Instruction Committee of the Borough of West Ham, and to Mr. Briscoe, B.Sc., the Principal of the Institute, for the very kind way in which the wants and wishes of the Club with respect to the proposed meetings in the Institute had been met by them. As explained on the circular which had been sent to the Members, it was proposed in the future to hold the greater number of the winter meetings of the Club in the Institute.

The vote of thanks was carried by acclamation.

Mr. Briscoe, who was present, briefly replied, and said it was with great pleasure that on behalf of the Committee and the staff of the Institute he welcomed the Essex Field Club there, as a Society which had done so much to further the cause of scientific research and education in Essex. He hoped that the connection between the Club and the Institute, through the adjoining Museum, would long continue. Anything that he and his staff could do to aid the work of the Club they would do willingly, and they would consider it a privilege.

Messrs. Clifford F. Bull, J. Lewis Ffytche, F.S.A., W. Ping, M.A., F.C.S., and Alderman F. Smith, J.P., were elected members.

Mr. Avery read a further note upon Christopher Saxon, whose map of Essex, dated 1576, the oldest known map of the County, he exhibited. He also showed some fine prints of views in various parts of Essex, and amongst them a plate entitled, "Another View of Wanstead House," taken from the garden, and not from near the basin as usual. Mr. Avery said that the plates he exhibited formed part of a set from his collection which he proposed to place at the disposal of the Curator on loan for exhibition in the new Museum when completed. (Mr. Avery's Note will appear in the next volume).

Mr. Crouch expressed his admiration at the fineness of the plate exhibited, and gave a few particulars of the later history of Wanstead House.

Prof. Meldola, referring to Saxon's map, said it was a misfortune that in old maps they could not safely rely upon the accuracy of the coast-lines laid down upon them. In Saxon's map Walton was placed at some distance from the coast; if we could be sure that this was correctly set down, it would throw much light on the rate of erosion of the coast, a subject which was now greatly occupying the attention of geologists.

Mr. W. M. Webb, F.L.S., exhibited the specimen of the Centipede, *Scutigera coleoptrata*, found at Colchester for the first time in England, which formed the subject of his note in the last part of the ESSEX NATURALIST (*ante* p. 371).

Professor Meldola suggested that the myriopod might have been introduced amongst the roots of imported plants.

Mr. Cole instanced the case of the scarce Rose-beetle (*Gorimus nobilis*), which he once found, years ago, in Lord's Bushes, Epping Forest, and which had possibly been so introduced.

Mr. Crouch mentioned, as an example of an introduced species finding a congenial dwelling-place in England, the mollusc *Crepidula*, which was now spreading so rapidly in Essex waters.

Mr. Percy Clark, B.A., read a paper entitled "A visit to the Black-headed Gulls in Essex," which is printed in the present part (*ante* page 388).

In the course of the discussion which ensued, Mr. Clark said he thought that by far the greater number of the gulls frequenting the Thames and the London Parks were the Black-headed Gull (*Larus ridibundus*).

The Chairman, in proposing a vote of thanks to Mr. Clark, said that if other members of the Club would use their eyes as well as the author had done, some interesting and valuable papers might often be brought forward.

Mr. E. Lovett gave a demonstration lecture on "Primitive Methods of Obtaining Fire." He illustrated his remarks with a series of examples of fire-making appliances from his own collection. (An abstract of the lecture will be published in the next volume of the E.N.)

A cordial vote of thanks was passed to Mr. Lovett for his very interesting lecture.

Mr. T. V. Holmes, F.G.S., as the Club's Delegate at the British Association Meeting at Bristol in September last, read his report, which is set out, *ante* page 393 in the present part.

Remarks were made by the Chairman and by Mr. W. Cole, and the meeting ended.

"SOILS AND SUBSOILS, FROM A SANITARY POINT OF VIEW, WITH SPECIAL REFERENCE TO LONDON AND ITS NEIGHBOURHOOD."

BY HORACE B. WOODWARD, F.R.S.

THE above *Memoir* of the Geological Survey was published towards the end of 1897, by Her Majesty's Stationery Office. As a considerable portion of the County of Essex lies within its scope, it is hardly necessary to give reasons why it should be introduced to readers of the ESSEX NATURALIST.

It is both short and inexpensive, consisting of 64 octavo pages, and being obtainable for half-a-crown. At the end is an excellent geological map, printed in colours, of the sub-soils of the country around London, which a very few years ago would have been thought cheap at double the price asked for the whole work. It is a "drift" map on the scale of four miles to the inch. On its northern edge appears St. Albans, Broxbourne, and Writtle, on its southern Guildford, Dorking, and Reigate. Windsor may be seen near its western border and within its eastern limits are West Malling, Gravesend, East Tilbury, Langdon Hills, and Billericay. And eighteen sections, illustrating various points discussed in the memoir appear here and there among its pages.

In the introductory chapter Mr. Woodward describes the general geological structure of the district, pointing out the relations of the various formations to each other. In the second he treats of the various subsoils, including the "Made Ground," which cannot be ignored in towns of any antiquity. In London, he tells us, it may be from a foot or two to about 25 feet in thickness. "At the Bank of England there were 22 feet of "made ground" resting on 4 feet of gravel." He remarks that "made ground" is not always an unsatisfactory foundation for a house, though extremely objectionable when it consists of rubbish containing a considerable admixture of animal and vegetable refuse, which has filled a pit from which sand and gravel have been taken. Then he notes the generally undesirable nature of alluvium as a site for dwellings, and points out how large a proportion of old London and the villages around it is built on tracts of the valley gravel of the Thames and its tributaries. Other gravelly, sandy and sandstone sites are then considered, also the "mixed subsoils" furnished by the Woolwich and Reading Beds, the Valley Brickearth or Loam, and the Clay and Loam with Flints. Then came the clayey formations. They consist of the Boulder Clay, London Clay, Gault and Weald Clay. And lastly the one Limestone, known as the Chalk.

Chapter III. consists of "General remarks on the subsoil with reference to sites and foundations for houses." Mr. Woodward mentions the various circumstances which need consideration in the case of gravelly, clayey, chalky or other sites for houses. Chapter IV. contains remarks on Water Supply and Drainage, some account being given of the various modes of supplying London with water from an early period to the present day. Mr. Woodward concludes with a short dissertation on Rural Water Supply and Sanitation. Chapter V. is devoted to "General Sanitary Considerations in regard to Situation and Surroundings of houses," and the concluding chapter deals with the best sites for cemeteries.

Mr. Woodward's remarks on the various matters touched upon in this memoir are the more valuable because he is always careful to point out all the various circumstances which may tell for or against any given site, and is far from looking at health as being a mere question of subsoil. A few words on the admirable map accompanying this memoir may be useful, especially to the non-geological reader, as the index to it shows primarily the various beds as belonging to a sandy, gravelly or clayey series and not in the order of their antiquity. The oldest formation within the limits of the map is the Weald Clay, which is seen on the southern border from Dorking eastward. Then adjacent to the Weald Clay, but north of it, came the Lower Greensand, the Gault, and the Upper Greensand. North of them the Chalk occupies a much broader belt of ground between Guildford and Gravesend, and may be seen also in the north west corner of the map around Chesham. The other beds shown are of very various ages but all of later date than the Chalk. The letters and figures on the various formations mark their relative antiquity. Thus on the Weald Clay may be seen "h 1," on the Chalk "h 5," the beds between them being h 2, h 3, and h 4, according to age. Similarly the lowest Tertiary series is that on which "i 1-2" appears, and so on; the post Tertiary beds not having any letter or figure upon them at all. Then, to give clearness to the map, it has been found desirable to reduce the number of tints under which patches of high level gravel appear on the drift maps of one-inch to the mile. For example, in the part of Essex within the limits of this map there are three gravels of various ages, coloured on the one-inch map, red, light-pink and orange respectively. These are all coloured red on Mr. Woodward's map because they are all found on high ground and not in valleys. However, all these gravel patches are of latter date than the Bagshot Beds, and if they vary as regards their relation to the Boulder Clay, they are all older than the valley gravels of the Thames and Lea. And in this case the chief requisite is not a minutely accurate classification as regards time, but a clear perception of the positions of the various areas of low and high-level gravels, of sand, limestone, or clay.

T. V. HOLMES.

NOTES—ORIGINAL AND SELECTED.

METEOROLOGY.

Rainfall and Temperature in Essex in 1898.—In continuation of the reports for 1897 (see E.N., *ante* p. 237) we now print some records from various observers in Essex during 1898:—

Lexden, near Colchester.—Mr. S. F. Hurnard writes:—"I send you the monthly totals for rainfall as measured by my 5in. certified Snowdon Guage at Lexden, with brief remarks on the general weather of each month:—

Month.		otal.	Remarks.
Jan.	..	.72	Very mild.
Feb.	..	·71	First half generally mild, then colder.
Mar.	..	1·48	Coldest month of the winter, some snow.
April	..	1·12	Variable— cold winds and frost.
May	..	2·85	Cool and showery—crops looking well.
June	..	1·82	Cool. Hay well secured.
July	..	·98	Cool. Sixteen days absolute drought.
Aug.	..	1·11	Very hot period, 10th to 23rd.
Sept.	..	·32	Hottest September for many years, 19 days absolute drought.
Oct.	..	1·97	Calm and mild. Root crops helped by the rain.
Nov.	..	2·16	Low even temperature, little frost.
Dec.	..	2·36	Generally mild and unsettled.
Total		17·60.	

"There was a partial drought of 46 days from August 30th to October 14th, during which ·44 inch of rain fell. The year was notable for the absence of very heavy falls of rain in 24 hours, the maximum fall in one day being ·66 inch. on December 6th."

Notes on Meteorology at Colchester.—The following observations are based on the readings taken daily at the Borough Surveyor's Office, Stanwell-street, Colchester, for the past *twelve years* (see also *ante* p. 239), as communicated to the *Essex County Standard*:—

"The hottest day during the whole of that period was September 9th, 1898, when the thermometer rose to 92 degrees in the shade, the next highest reading being 91 degrees on June 24th, 1898, and 91 degrees on July 21st, 1896 The heat throughout the month of September was also exceptional, 83 degrees in the shade being registered as late as September, 18th, 1898, also a record heat for the time of the year. The coldest day was February 21st, when 19 degrees was registered, or 13 degrees of frost, the greatest cold recorded being in February, 1895, when the thermometer went down to zero.

The highest and lowest barometic readings for the year 1898 are respectively 30·77 on January 24th, and 28·65 on November 25th, the highest and lowest recorded 30·90, June 9th, 1896, and 28·40 Nov. 11th, 1891.

In 1898, 18·12 inches of rain fell during the whole year, making the dryest year on record, with the exception of 1887, when only 17·25 inches fell, but if we take the rainfall for twelve months, commencing in September, 1897, we get the phenomenally low rainfall for a year of 15·03, which is a record. The wettest year was 1892, with 26·68 inches. The period of longest drought in 1898 occurred in August and September, as only about ¼-inch fell in nine consecutive weeks, while no rain fell between August 30th and September 19th. There were only 128 wet days in 1898, the lowest number ever recorded, the greatest number being 188 in 1894, and there were only 121 wet days between September, 1897, and September, 1898. The greatest rainfall in 24 hours occurred on December 6th, when ·76 inches fell, the heaviest fall recorded being 1·76 inches on June 22nd, 1897."

Fingringhoe.—Mr. Thomas B. Grubb communicates the following summary of the Rainfall and Temperature at Fingringhoe, four miles S.E. of Colchester, during 1898 (see E N. *ante* p. 238 for the records for 1897):—

	Rainfall.	Temperature.			Number of Days on which measureable
	Inches.	Max.	Min.	Mean.	rain fell.
January	0·71	45·73	38·29	42·01	5
February	0·96	45·71	34·57	40·14	12
March	1·62	46·03	33·26	39·65	15
April	1·08	55·10	39·13	47·12	8
May	2·26	58·39	43·51	50·95	18
June	1·81	64·71	49·37	57·04	12
July	1·23	68·42	51·23	59·82	8
August	1·22	71·45	54·81	63·13	11
September	0·30	66·57	51·20	58·88	3
October	2·17	58·19	49·61	53·94	11
November	2·11	49·60	40·37	44·98	14
December	1·94	48·06	38·97	43·52	12
Total	17·41	Mean for year		50·10	129
1897	21·05			49·45	137
1896	20·90			49·67	134

Highest shade temperature, 84 degrees, on September 9th. Lowest ditto, 24 degrees, on February 21st and March 6. Greatest rainfall in 24 hours, 0·55, on October 30th. Warmest month, August. Coldest month, March. There were 15 nights in March on which the thermometer on the screen fell below freezing point.

Mr. Grubb had commented on the extreme dryness of the cereal year that ended with September, 1898. "At that time," he writes, "it seemed likely that 1898 would be a record year in East Anglia for lightness of rainfall, but the past three months having given us over six inches of rain, the total comes out nearly 17½ inches, or about an inch in excess of the record year (1874). The mean temperature of the year, 50·10, is in excess of both 1896 and 1897, but this excess has accrued entirely during the autumn and winter months, January, September, October, and December, all showing a mean much about the average.

"The temperature of the three spring months was below the average, as also two of the summer months, June and July, August alone reaching the mean. March was the coldest month in the year, sharing this distinction with the years 1883 and 1886. The season as a whole may be put down as a productive one, from an all-round point of view, the abundance of hay and straw making amends for considerable deficiency in the root crops, while the extreme mildness of the last quarter atoned to a large extent for the absence of autumn grass at the time when we usually expect to get it.

"As regards the water supply in country districts, this is not yet by any means fully replenished, and, unless we are to have a repetition in 1899 of the late water famine, it is to be hoped that the rainfall during the next two months may be fairly ample."

Ramsey, near Harwich.—Mrs. K. Hempson, Hill House, Ramsey (about 3½ miles west from Harwich) writes:—"As our register in this parish differs considerably from others in the County, it may interest your readers to have a summary of it. Probably our situation (1½ miles from the river Stour and 3 miles from the sea) may account for this. On only one day in the year did we register an inch, and it is a curious coincidence that for three consecutive years we have registered upwards of an inch on three consecutive days—viz.: June 10th, 1896, 1·00; June 8th, 1897, 1·06; June 9th, 1898, 1·07.

RAINFALL FOR 1898.

January	1·00
February	·91
March	2·12
April	1·31
May	2·97
June	3·14
July	1·3
August	1·40
September	·31
October	2·15
November	2·39
December	2·28
Total	21·31

Danbury.—The Rev. J. Bridges Plumptre, Rector of Danbury, sends a summary of his register of rainfall kept during the year 1898. He remarks: "We fancied that the year 1897 was a dry one, but 1898 has considerably surpassed its predecessor in this respect. Here in Danbury in 1897 there fell 21·97 inches rain, with 176 days on which rain fell, but in 1898 the total rainfall does not exceed 15·95 inches, with 136 days on which rain fell. Again in

1897 there was only one partial drought—viz., in October; whereas in 1898 there was a partial drought in January, and no less than three absolute droughts - viz., in July, August, and September.

" The gauge is one foot above the ground and 365 feet above sea-level; the diameter of funnel 5 inches:—

Month.	Total Depth. Inches.	Greatest fall in 24 hours. Depth.	Date.	Number of days on which 0·1 or more fell.
January	·70	·22	5th	9
February	·68	·16	3rd	11
March	1·84	·55	25th	13
April	1·26	·43	27th	10
May	1·89	·30	19-20th	20
June	1·67	·75	9th	13
July	·69	·19	28th	9
August	1·05	·62	7th	7
September	·25	·16	29th	2
October	1·98	·47	29th	16
November	2·01	·60	21st	13
December	1·93	·63	6th	13
Total	15·95	—	—	136

" Partial drought from January 7th to February 4th, *i.e.*, 29 days in which there fell ·27in. rain.

" Absolute droughts—(1) July 2nd—17th; 16days. (2) August 9th—26th; 18 days. (3) August 30th—September 17th; 19 days.

Terling.—Mr. C. Boutflower, jun., of Terling Vicarage, sends to the *County Chronicle* figures showing that the amount of rainfall measured there during the past year was 18·88 inches. This fell on 142 days. The rainfall at Terling for the preceding four years was as under:—1894, 26·06 ins.; 1895, 18·66 ins.; 1896, 25·82 ins.; 1897, 26·58.

Chelmsford.—Mr. F. Chancellor thus summarises his daily observations of rainfall at Chelmsford in 1898:—

	Inch.
January	0·81
February	0·83
March	1·45
April	1·26
May	1·98
June	2·08
July	0·77
August	0·97
September	0·30
October	2·54
November	2·03
December	2·25
	17·27

" It will be seen that we are 5¾ inches below the average for the last 30 years—viz., 22·98." See E.N. *ante* p. 238.

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Contributions.—The Editor will be glad to receive communications relating to the above-named subjects; also Books and Papers for notice in the Journal, and cuttings and extracts from periodicals and newspapers, furnishing information respecting the occurrence of new or uncommon plants or animals, the exposure of new geological sections by railway or other works, new well-sinkings, discoveries of archæological interest, &c. In short, any material will be welcomed which may fairly be claimed as coming within the scope of the Journal.

All communications, books for notice, &c., should be addressed:—

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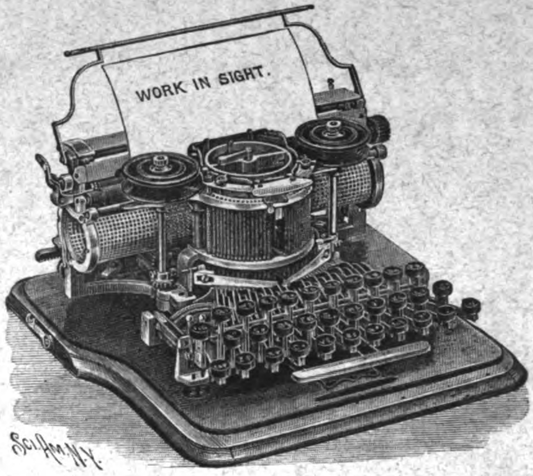
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